



## **Deliverable No. 11.2**

### **Report on the first evaluation workshop round**

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RE	Restricted to a group specified by the consortium (including the Commission Services)	<b>X</b>
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#### ABSTRACT:

This deliverable summarizes the first evaluation workshop taken place during the consortium meeting in Leuven in October 2014. From the 15<sup>th</sup> of October endusers of CHIC were able to evaluate the following 5 tools: DrEye, BraTumIA, CCGVis, Timeline and clinical data repository, and Upload Tool. The evaluation was done according to the criteria defined in D11.1. Main issues were usability and sustainability & maintenance. According to the results of the evaluation workshop all tools need to be improved to fulfil all criteria for usability and sustainability. An iterative process between all stakeholders of CHIC will achieve this. A feedback loop to the developers is most important.

#### KEYWORD LIST:

Evaluation; Usability; sustainability & maintenance; DrEye; BraTumIA; CCGVis; Timeline and clinical data repository; Upload Tool;

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<sup>1</sup> R=Report, P=Prototype, D=Demonstrator, O=Other

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## 1 Executive Summary

This deliverable describes the first evaluation workshop that took place during the consortium meeting in Leuven in October 2014. From the 15<sup>th</sup> of October endusers of CHIC were able to evaluate the following 5 tools: DrEye, BraTumIA, CCGVis, Timeline and clinical data repository, and Upload Tool. All these tools were installed on virtual machines provided by FORTH. One needed to connect with Remote Desktop from Windows, or another similar program from other OS, in order to connect to them via the following IPs:

- 139.91.210.29
- 139.91.210.44
- 139.91.210.45
- 139.91.210.46

The username for the virtual machines is **CHIC1** with the password **CH1CHCH1CH**.

The evaluation was done according to the criteria defined in D11.1. Main issues were usability and sustainability & maintenance.

The evaluation did continue after the Leuven meeting up to the 20<sup>th</sup> of November to get as much reports of endusers as possible. Altogether 48 evaluations were done by endusers of CHIC ranging from 6 to 12 evaluations per tool.

This deliverable describes in chapter 2 the evaluation process and gives the documentation of the five mentioned tools for evaluation in chapters 3 to 7. In chapter 8 results of the evaluation of the different tools is given with links to detailed information of all evaluated items.

According to the results of the evaluation workshop all tools need to be improved to fulfil all criteria for usability and sustainability. An iterative process between all stakeholders of CHIC is installed and will achieve this. A feedback loop to the developers is established. The different tools are compared in chapter 9 and conclusions are driven.

## 2 Introduction

### 2.1 Purpose of this document

The first evaluation workshop round was held at the consortium meeting in Leuven, taking part from the 15<sup>th</sup> to the 17<sup>th</sup> of October 2014. It was decided to test the following tools during this workshop:

- DrEye
- BraTumIA and brain segmentation
- CCGVis and volume rendering
- Timeline and clinical data repository
- Upload and download tool

All these tools were installed on virtual machines provided by FORTH. The links for the Virtual machines are given below. One needed to connect with Remote Desktop from Windows, or another similar program from other OS, in order to connect to them via the following IPs:

–139.91.210.29  
–139.91.210.44  
–139.91.210.45  
–139.91.210.46

The username for the virtual machines is **CHIC1** with the password **CH1CHCH1CH**.

The evaluation did continue after the Leuven meeting up to the 20<sup>th</sup> of November to get as much reports of endusers as possible.

For the evaluation a questionnaire was created and made available online for each of the tools:

- DrEye
  - [https://docs.google.com/forms/d/1wxYCM\\_nCpUFry-Doyg\\_4ltfy\\_GgoaYLpGJWo0LCo21c/viewform](https://docs.google.com/forms/d/1wxYCM_nCpUFry-Doyg_4ltfy_GgoaYLpGJWo0LCo21c/viewform)
- BraTumIA and brain segmentation
  - <https://docs.google.com/forms/d/14vtbaXbQR0HCEwGYF4IPTxCuUwf-5Ekxxf6O9RukKt0/viewform>
- CCGVis and volume rendering
  - [https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF\\_W0y0KikAvgphztv0/viewform](https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF_W0y0KikAvgphztv0/viewform)
- Timeline and clinical data repository
  - [https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b\\_1xAwVB7\\_zF4Q01DPC470Jd2U/viewform](https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b_1xAwVB7_zF4Q01DPC470Jd2U/viewform)
- Upload tool
  - [https://docs.google.com/forms/d/10kli5exkvQ0\\_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewform](https://docs.google.com/forms/d/10kli5exkvQ0_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewform)

The questionnaire is based on the criteria written in D11.1 (Appendix 2). As the tools are pre-installed the section Installability is not part of the evaluation. Analysis of the questionnaire is divided in two parts: Usability and Sustainability & Maintenance. For the first evaluation workshop usability is

regarded as most important. The ISO/IEC 9126 Software engineering international standard for the evaluation of software quality is described in detail in D11.1 and is given as a summary here. The standard is divided into four parts:

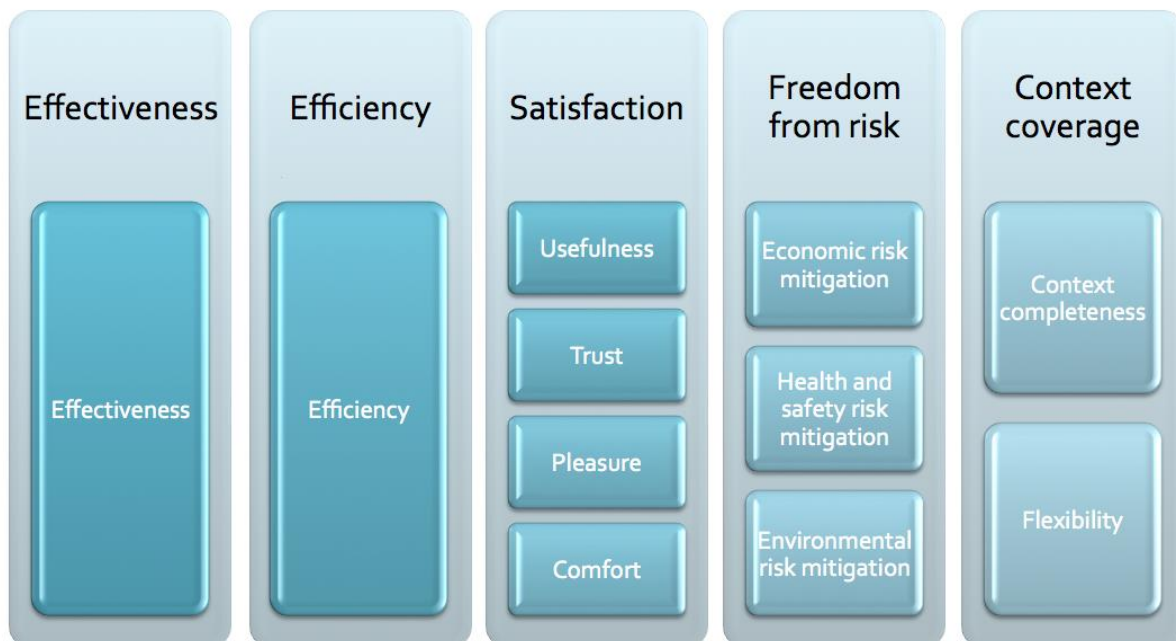
- Quality Model (functionality, reliability, usability, efficiency, maintainability, portability)
- External Metrics (the way the software run)
- Internal Metrics (the software as static product)
- Quality in use (use in real conditions)

The ISO/IEC 25000 Systems and Software Quality Requirements and Evaluation (SQuaRE) supersedes ISO/IEC 9126, which is divided into the 5 categories:

- Quality Management
- Quality Model
- Quality Measurement
- Quality Requirements
- Quality Evaluation

The quality of a system is the degree to which a system satisfies the stated and implied needs of its various stakeholders, and thus provides value. Quality in use and product quality are distinguished.

Quality in use is described by 5 categories that are shown in the following figure:





Product quality is described in 8 categories as shown in the following 2 figures:



The categories compatibility and security are not checked in this evaluation workshop.

It needs to be mentioned that the categories evaluated are of different importance depending on the tool. There is a difference between an end-user application, like DrEye, or BraTumIA and the 'upload tool'. In addition the categories supportability, evolveability and analysability can better be judged by people more involved in the development compared to so called 'endusers' or 'clinical users'. Nevertheless these concepts were also evaluated by the endusers.

The manuals of all 5 tools are given in section 3 to 7. Results of the Evaluation are given in section 8 separated for each tool.

### 3 DrEye – An advanced viewer for medical images

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In the following sections the DrEye User Manual (version 5.7) is displayed. The last updated version of DrEye can be downloaded at: <http://biomodeling.ics.forth.gr/downloads/2014/DrEye.5.7.5406.zip>.

#### 3.1 Installation






##### 3.1.1 System Requirements

Doctor Eye is a native windows application. The minimum system requirements in order to be able to start Doctor Eye, are the following:

1. Windows operating system 7 or later (for x86 or amd64 cpus)
2. Dual core processor (Intel i5 or better).
3. At least 4Gb of memory

##### 3.1.2 Prerequisites (check for .Net framework 3.5)

1. Make sure that you have Microsoft .NET Framework 3.5 installed on your system. To check if you have .NET Framework 3.5 installed:
  - a. Open the Control Panel. Click on **Start Control Panel**.
  - b. In the Control Panel open the **Programs and Features** icon.
  - c. Try to locate **Microsoft .NET Framework 3.5** (it might be followed by a SP number). If you could not locate it or if the number is less than 3.5 then you need to install the latest (free) edition of Microsoft .NET Framework, which can be found at <http://www.microsoft.com/downloads>

	Microsoft Document Explorer 2008	26,2 MB
	Microsoft Device Emulator version 3.0 - ENU	2,29 MB
	Microsoft .NET Framework 3.5 SP1	28,0 MB
	Microsoft .NET Compact Framework 3.5	81,5 MB
	Microsoft .NET Compact Framework 2.0 SP2	93.2 MB

##### 3.1.3 Install Doctor Eye

2. Download the appropriate version of the software from the following address: <http://biomodeling.ics.forth.gr/> Select the Tools menu from the navigation menu bar and click on Dr Eye
3. Extract the contents of the zipped file to the local drive C:. The folder **C:\DrEye.version\_number** (e.g. **C:\DrEye.5.7.5256**) should have been created.
4. Move to the **C:\DrEye.version\_number** folder

5. Right click on the **DoctorEye.exe** file. Click **Send To Desktop (create shortcut)**. Now the icon that is going to be used by the user - in order to start the application - has been created on the Desktop.

### 3.2 Start using DoctorEye

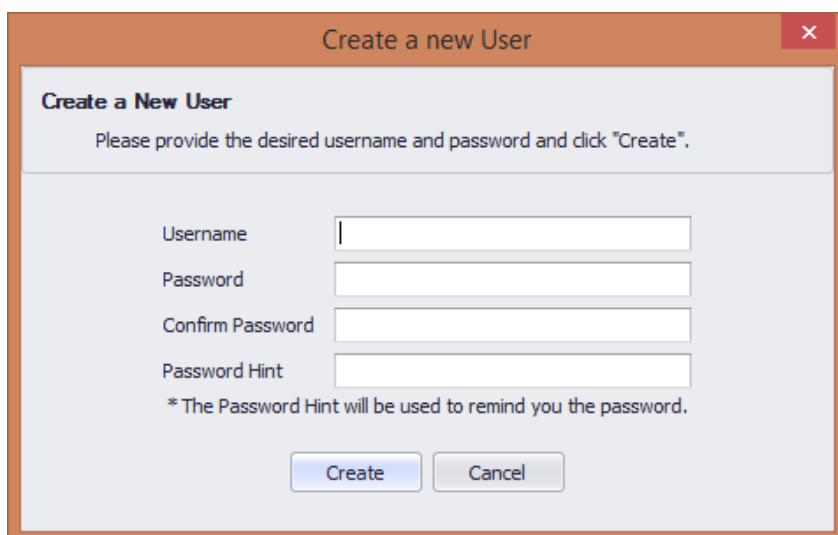
In order to start the application double click the Doctor Eye shortcut icon, the Red Cross icon, located on the Desktop (Provided that you have followed the procedure described in the installation instructions.).



After the application starts, the following Login window is displayed. Enter your Doctor Eye account information and press the Login button.

### 3.3 How to create a new user

In order to create a new user click on the **Create User** button located at the bottom left corner of the Login window. The following window appears. Enter your information at all the fields and press the **Create** button. If you accidentally pressed the Login Button at the previous window, press **Cancel** to return back.



**Create a new User**

Please provide the desired username and password and click "Create".

Username

Password

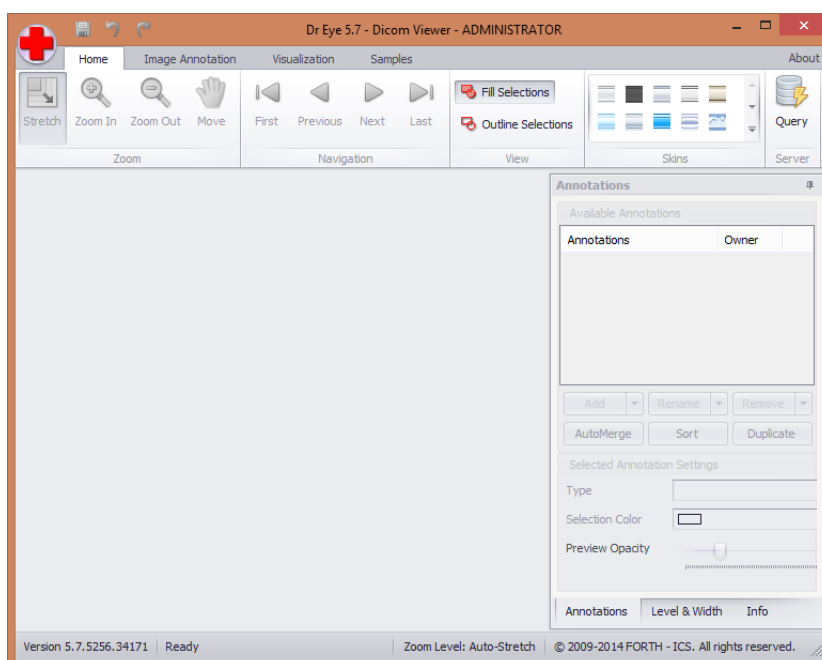
Confirm Password

Password Hint

\* The Password Hint will be used to remind you the password.

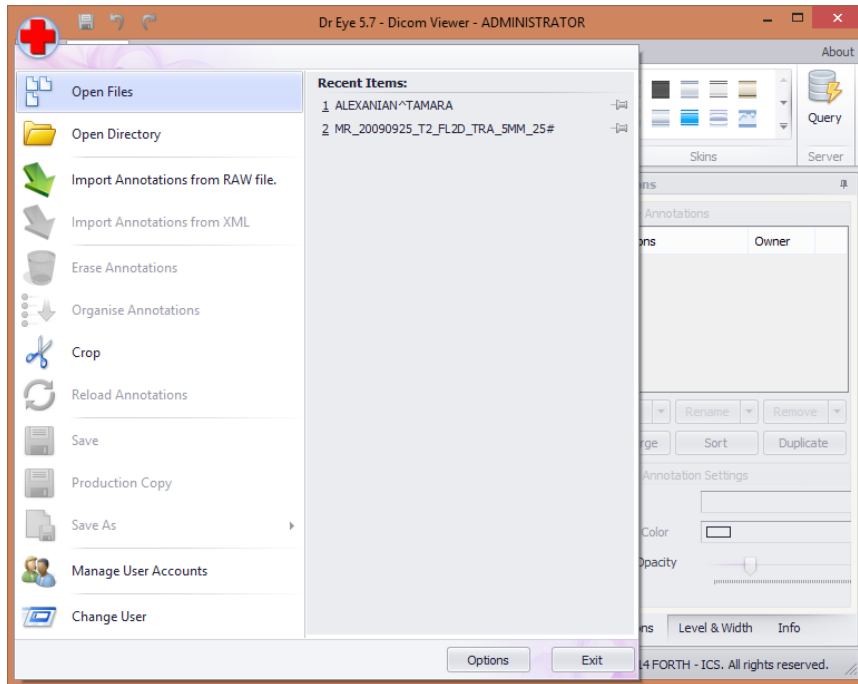
### 3.4 The main window

After you enter your Username and password to the login window, the main window of the Doctor Eye is displayed (the following window).

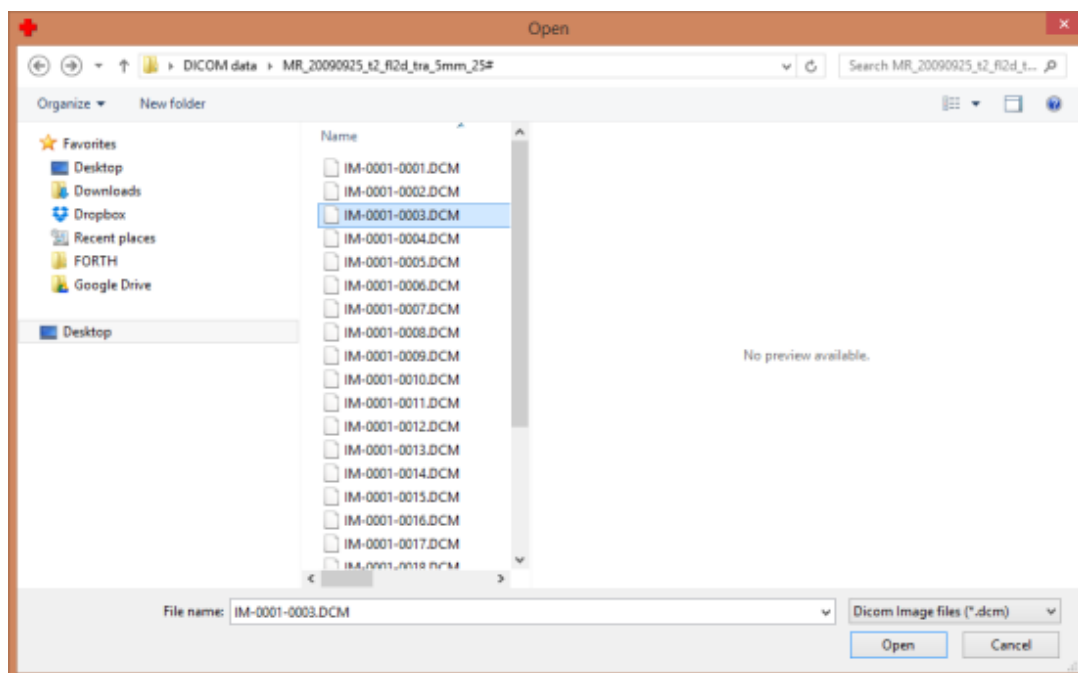


### 3.5 Open a single DICOM file

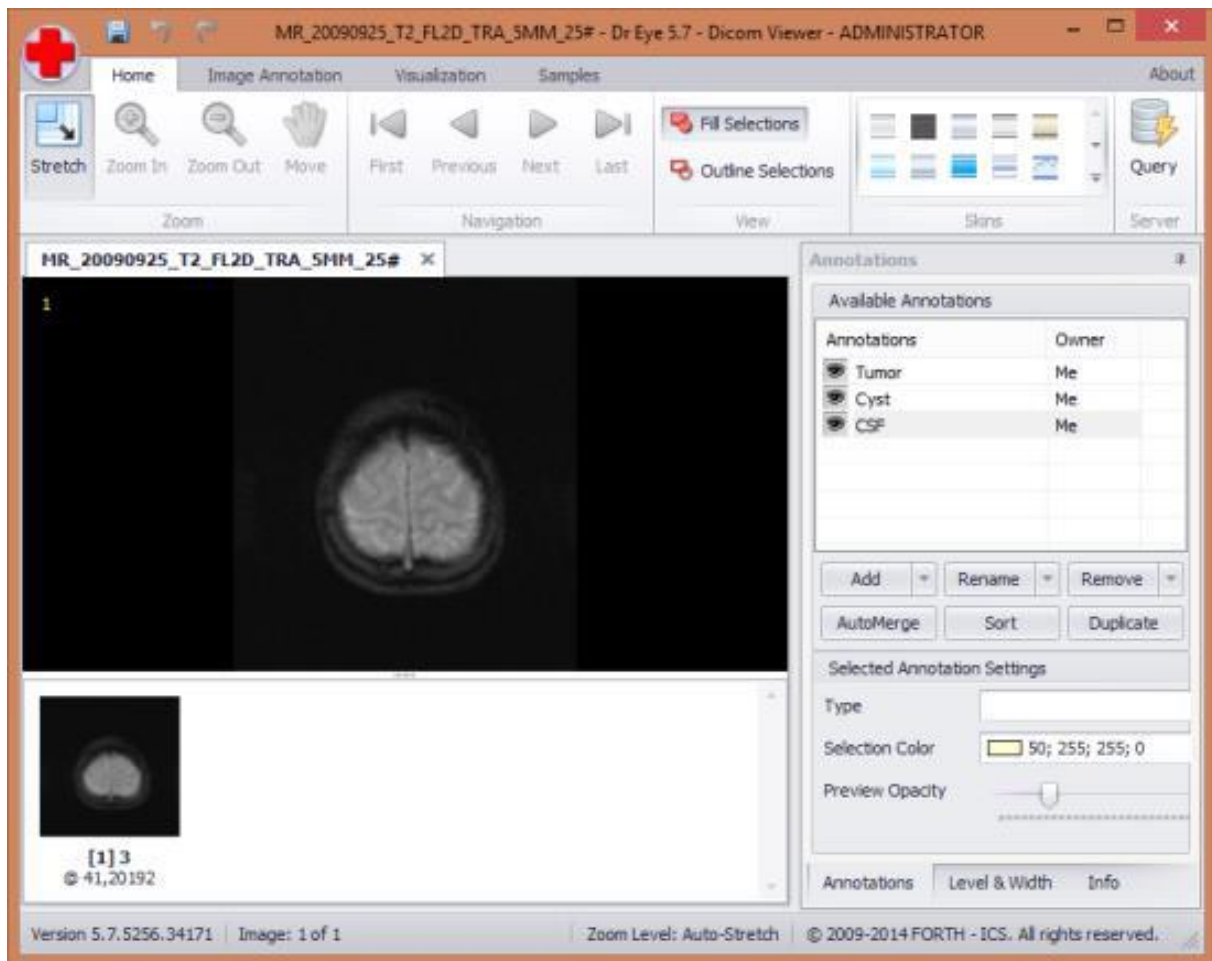
To open a single DICOM file, click on the Red Cross button and then select **Open Files**.



The Open dialog appears, in which you must specify the file you wish to open. Browse to the DICOM file (usually a file with .dcm extension) you wish to view, select it and click the **Open** button.



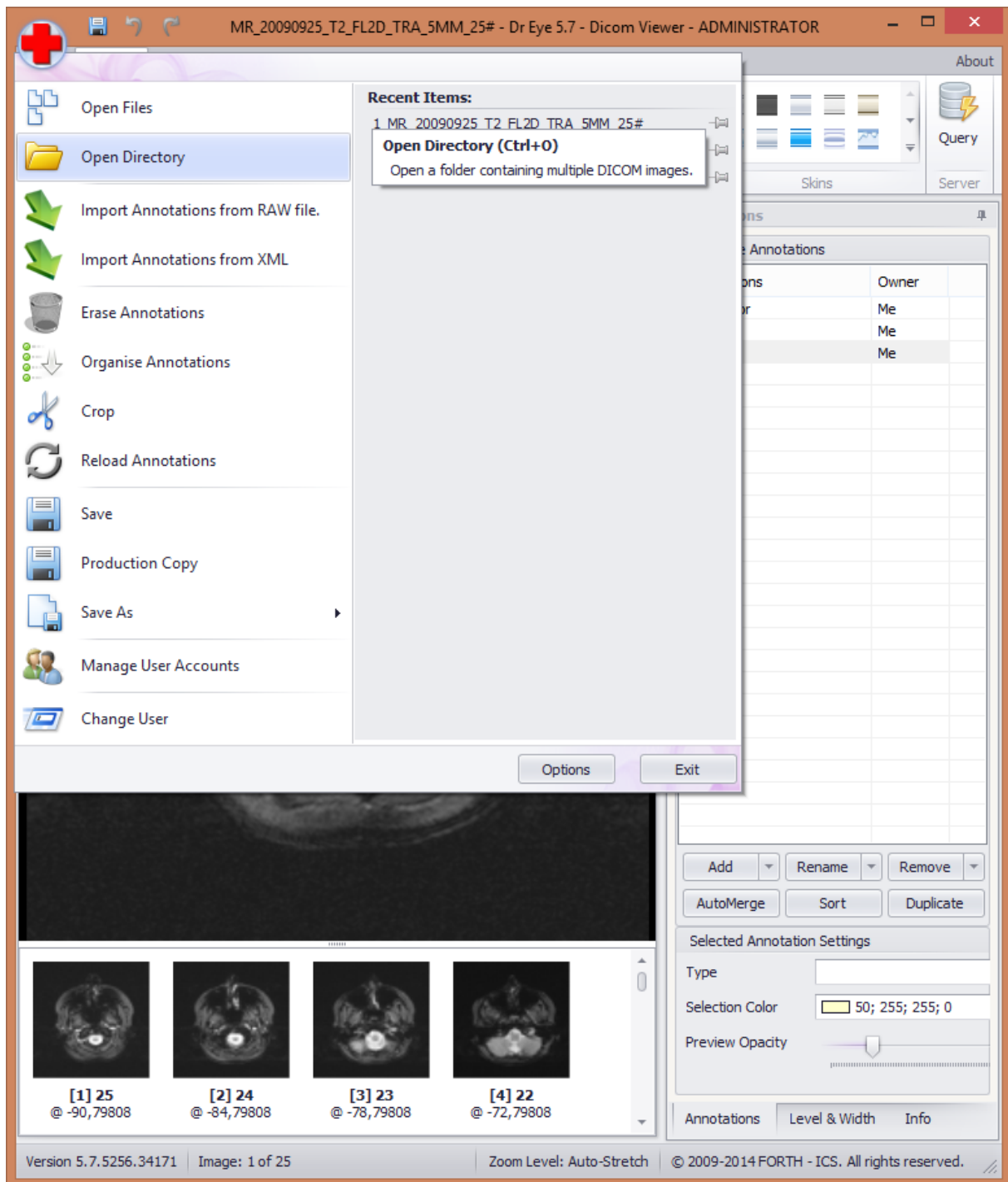
*The Open dialog window.*



*The Main window with one DICOM loaded.*

### 3.6 Open a directory containing DICOM files

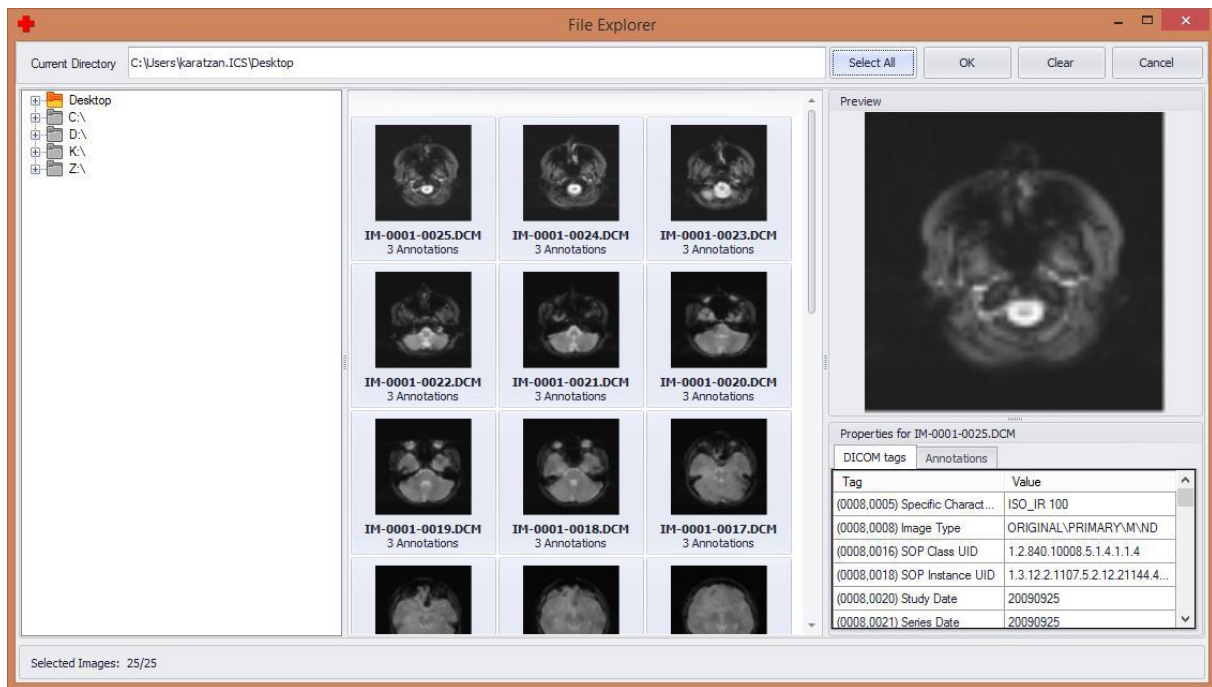
To open a directory of DICOM files, click on the Red Cross button and then select **Open Directory**.



The **File Explorer** dialog appears, in which you must specify the directory you wish to open.

At the center of the window lies a list of thumbnails of the selected images, while at the right is the preview area (where the selected image –the highlighted one- is displayed in a larger view).





Select the desired folder from the left side of the window, and you will see that the center of the window displays thumbnails of the images in the folder. If you wish to load all the images, click the **Select All** button. If you want to deselect all the selected images, click the **Clear** button.

Finally click the **OK** button to load the selected DICOM images in the viewer.

At the section, which follows, there is the guide on how to select multiple images using the File Explorer.

### 3.6.1 Ways to select multiple files.

#### Select multiple files that are grouped together

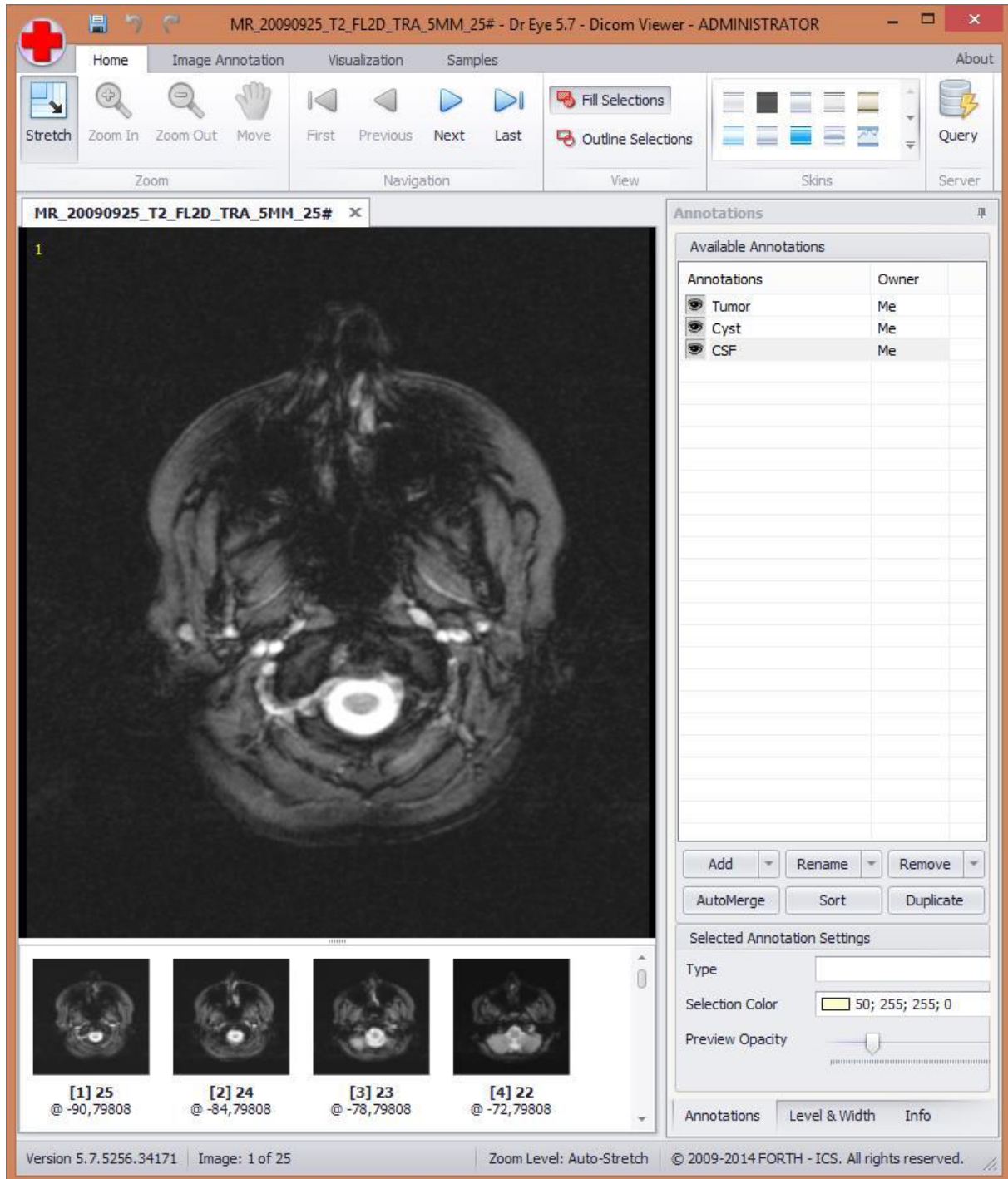
If you need to select multiple files that are all grouped together follow the below steps.

1. Select the first file by clicking it. The image thumbnail will be highlighted, thus indicating that it is selected.
2. **Shift + Click** on the last file that you desire to select. This will select all the files in-between the first and last file.

#### Select multiple files that are not grouped together

If there are multiple files you need to select but they are not grouped together follow the below steps.

1. Select the first file and then press and hold the **Ctrl** key.
2. While holding down the **Ctrl** key, click on each of the other files you wish to select.



Main window with multiple DICOM loaded.

### 3.7 Reload annotations



Reload Annotations

You have been working on an MRI dataset, but the results are not satisfactory and you judge that it needs to be done from the beginning. If you haven't selected save or save as while you are working, your work is not saved and thus you can reload the annotations saved from previous work stored in the medical files.

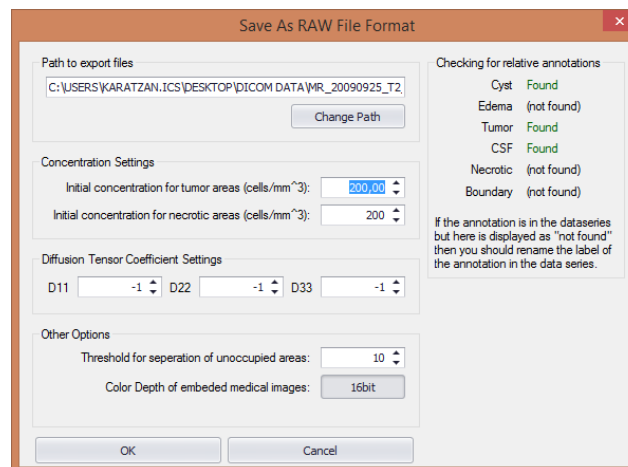
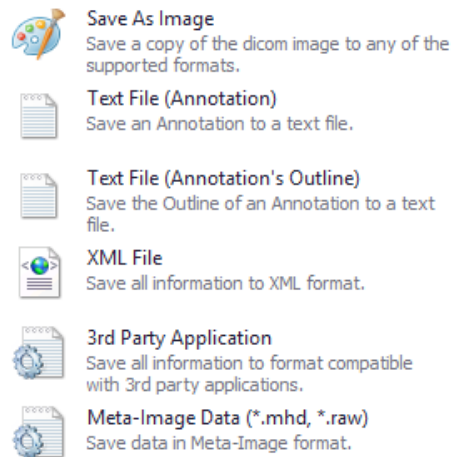
### 3.8 Save

You must select this option to save your work in the medical files before closing the platform the same way it is done in the Microsoft Office programs.

### 3.9 Save as

You can save your selections (annotations) alternatively as:

1. **Save As Image:** Saves a copy of the active dicom image at the selected path, to any of the supported formats (png, bmp, jpg, tiff, gif, ...)
2. **Text File (Annotation):** Presents the selected areas of your annotations in a txt file
3. **Text File (Annotation's Outline):** Presents the contour of your annotations in a txt file
4. **XML File:** Presents the area of your annotations in an xml file
5. **3rd Party Application:** This option produces 3 files:
  - a. **Size.dat:** Includes the size of the MRI Images and the number of the slices in the specific MRI dataset (ex. 512,512,22 means that the dimension of the images are 512 rows x 512 columns x 22 slices).
  - b. **TumorPoints.dat:** Includes the position of the tumor's points in all the slices.
  - c. **Volume.dat:** Includes all the points of the tumor in all slices, starting from the first point until the last one continuously (as a volume).
6. **Meta-Image Data:** Saves the active dicom series in Meta-Image format, a set of two files (.mhd and .raw) using specific annotations in the series (if they are defined) and the data from the configuration window as they are defined by the user (following screenshot).



### 3.10 Manage User accounts

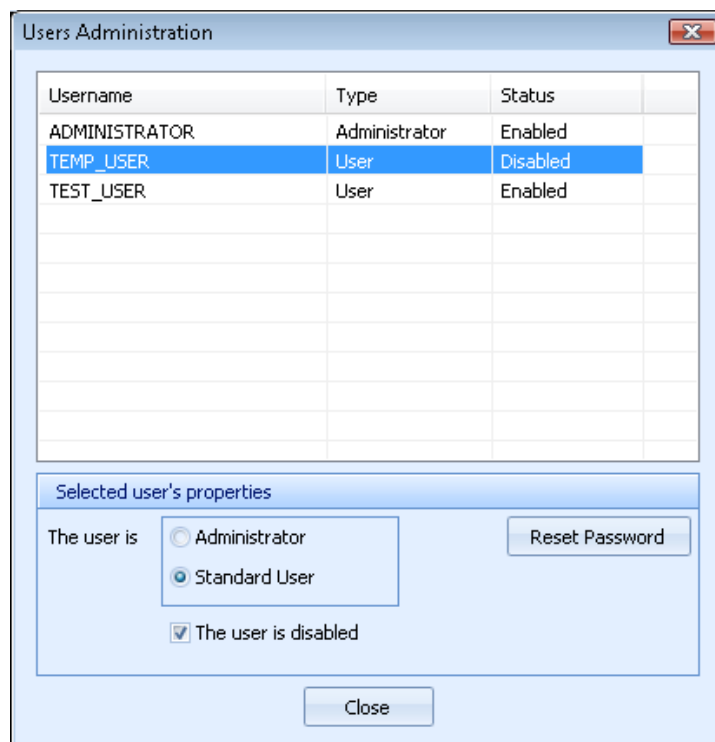
There are two user groups in the **Doctor Eye** application: The administrators and the simple users. The administrators can manage their work but also the work (ex. Annotations) of all the other users. However, the difference between a simple user and the administrator is that the former can only see the work of the other users, while the administrator can have full access to the data of all the users. The administrator can manage (add, rename or delete) other users' annotations. The administrator can also delete the account of a simple user, or to promote a simple user to administrator.

To manage users, you must login as **Administrator**. If you already logged in as a different user, you must log out first. To do so follow the guidelines described at the following sub-chapter, with title **"Change User"**.

**Quick Tip:** In order to access the administrator account, use the following information in the **Login** window.

Username: **ADMINISTRATOR**  
Password: **sadmin**

If you are already logged in as administrator, the **"Users Administration"** window will appear.



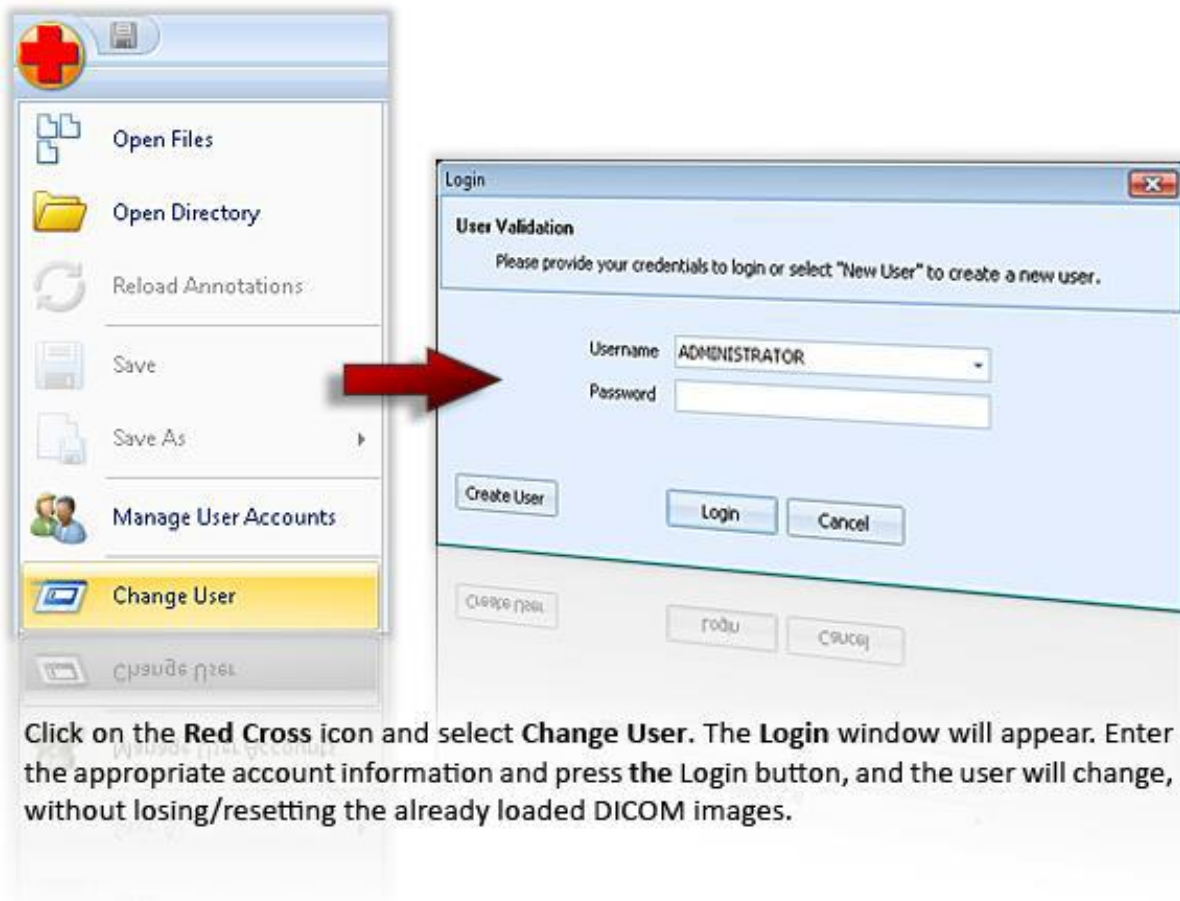
The **Users Administration** window provides the Administrator with the following options:

1. To disable the access of a specific user (by ticking the **User is disabled** option). The user whose account has been disabled cannot login, and therefore cannot use the program.
2. To allow other users to become Administrators as well (by ticking the **Administrator** option from the **Selected user's properties**).

3. To reset the password of a user (by clicking the **Reset Password** button, the **Reset Password Dialog** window will appear, and will guide you to create new one).

### 3.11 Change User

To change the operating user of the application, click on the Red Cross button and then select **Change User**.



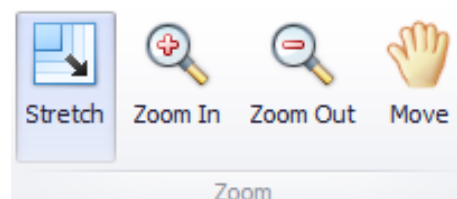
Click on the **Red Cross** icon and select **Change User**. The **Login** window will appear. Enter the appropriate account information and press the **Login** button, and the user will change, without losing/resetting the already loaded DICOM images.

### 3.12 Zoom modes

There are 3 zoom modes and an auxiliary navigation tool (the hand tool) in the application:

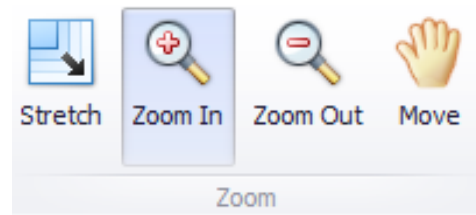
#### Stretch

The **Stretch** mode is by default enabled when the Doctor Eye application is loaded. The **Stretch** mode makes your current image fill as much of the screen as possible. This is frequently the optimal way to view a picture during editing. When the Stretch mode is enabled the **Zoom In** and **Zoom Out** modes are deactivated.



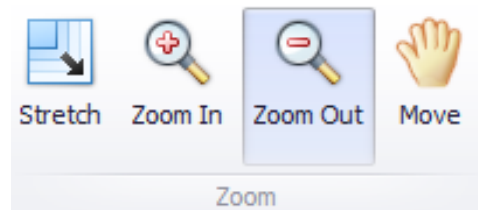
### Zoom In

To zoom into an image, just click on the magnifying glass icon **with the plus sign** in the toolbar. If the **Zoom In** button is deactivated and is not possible to be pressed, that means that the Stretch mode is still activated. If that is the case, press on the Stretch button (in order to deactivate it) and then the Zoom In and Zoom Out buttons will become active.



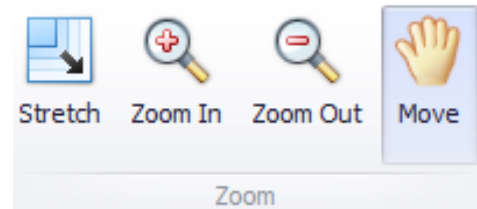
### Zoom Out

To zoom out, just click on the magnifying glass icon **with the minus sign** in the toolbar. If the **Zoom Out** button is deactivated and is not possible to be pressed, that means that the Stretch mode is still activated. If that is the case, press on the Stretch button (in order to deactivate it) and then the Zoom In and Zoom Out buttons will become active.

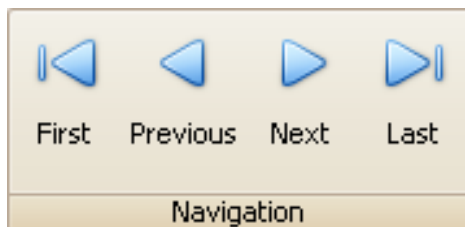


### Move

The **Move** tool allows you to move the entire image by dragging it with your mouse. When the **Move** tool is selected, click and drag anywhere in the image. If the **Stretch Zoom** mode is enabled the **Move** tool will not function.



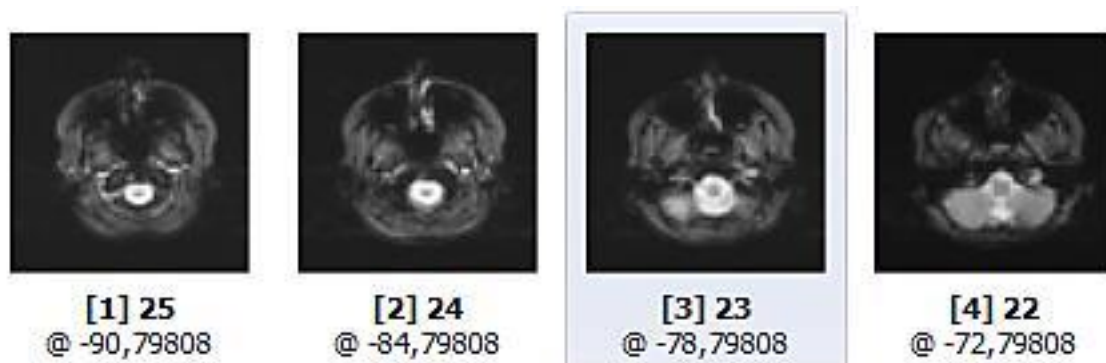
## 3.13 Navigation



In order to navigate through the loaded DICOM images you can use the Navigation buttons of the toolbar. The **First** button, displays at the main window of the application the first image from the list of thumbnails. The **Previous** button and the **Next** button, display -respectively- the previous and the next image from the list of thumbnails. And finally, the **Last** button, which displays the last image from the list of

thumbnails at the main window of the application.

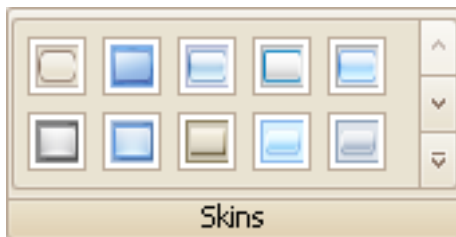
You can distinguish the currently displayed application by its blue bounding box (in the list of thumbnails).





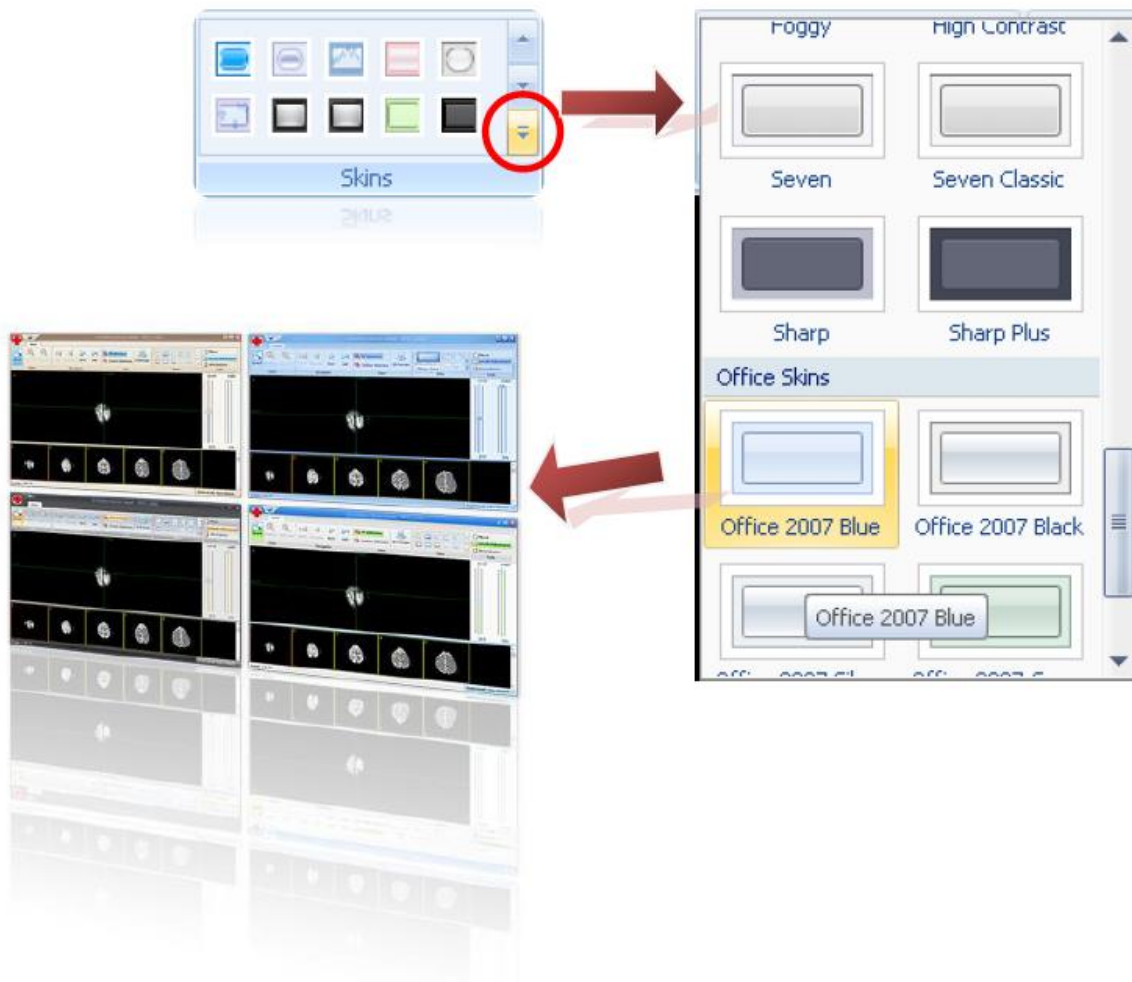
**Quick Tip:** The fastest way to move through the list of images, is by using the mouse wheel. Upwards movement of the wheel displays previous images, while downwards movement of the mouse wheel displays the following images.

### 3.14 Skins



"Doctor Eye" gives you the option to change the colors and the appearance of the controls by choosing one of the color themes from the **Skins** toolbar.

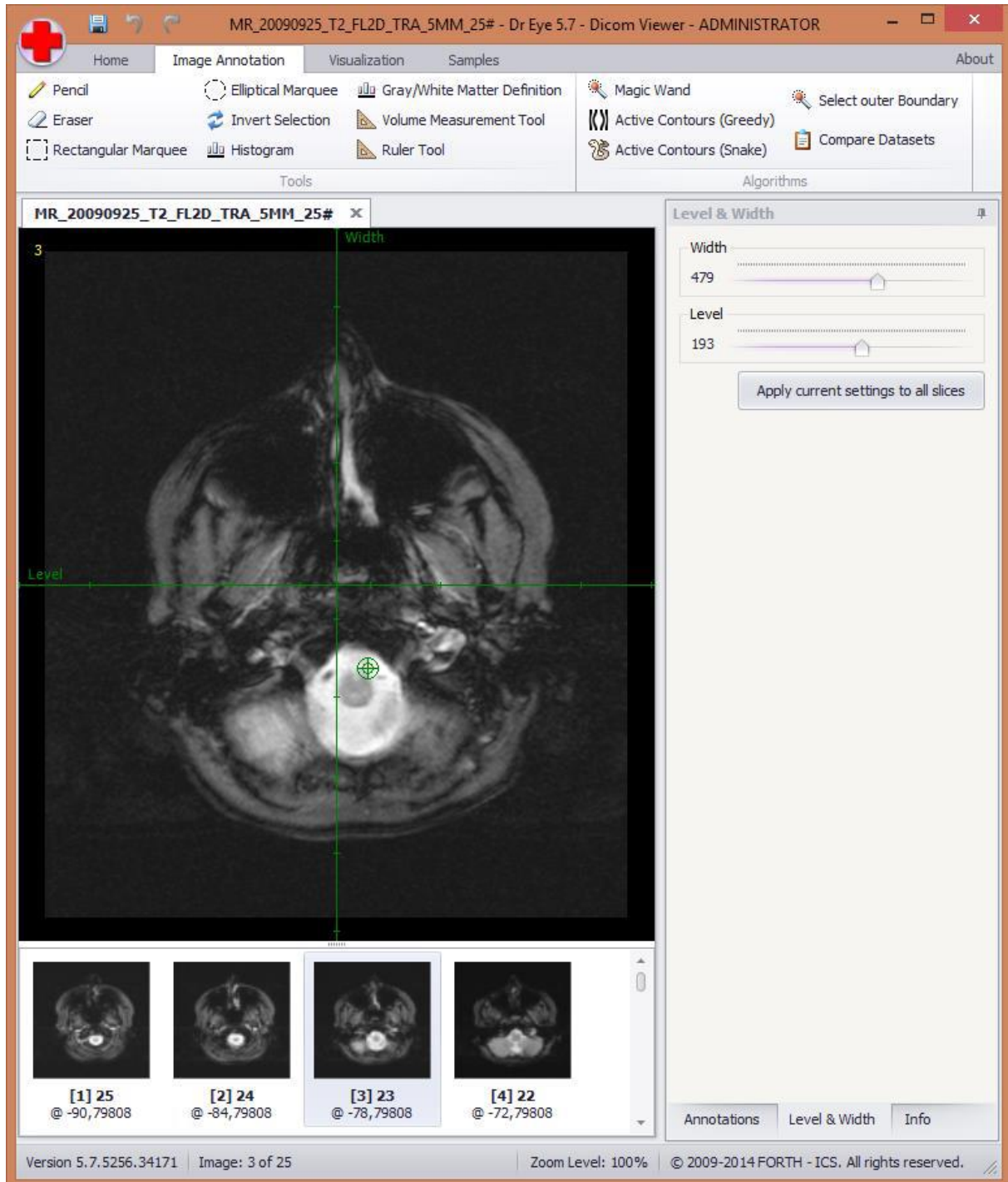
By clicking the lower arrow button at the "Skin" toolbar, a list will appear, with larger thumbnails, in order to make the selection easier.



### 3.15 Tools


#### Levels Adjustment

The **Levels Adjustment** tool allows you to adjust the *Window Width* and the *Window Level/Height* of the DICOM image. When the **Levels Adjustment** tab is clicked (bottom right), one green cross with tick marks appears on the main window (image below) while also appears an adjustment panel at the right side of the application window (image on the right).






### 3.15.1 Adjusting the Window Width of the DICOM image

There are two ways to adjust the image's **Width**. The first one is to use the **Width** slider at the adjustment panel, located at the right of the main window. The second one is by clicking anywhere in the main window. The vertical axis of the green cross, in the main window, represents the **Width** of the DICOM image. So the vertical coordinate of the point where the mouse button was pressed is converted to the corresponding **Width** value. A green crosshair appears at the last clicked point () in order to remind to the user the current value of the **Width**.

### 3.15.2 Adjusting the Window Level/Height of the DICOM image

There are also two ways to adjust the image's **Level**. The first one is to use the **Level** slider at the adjustment panel, located at the right of the main window. The second one is by clicking anywhere in the main window. The horizontal axis of the green cross, in the main window, represents the **Level** of the DICOM image. So the horizontal coordinate of the point where the mouse button was pressed is converted to the corresponding **Level** value. A green crosshair appears at the last clicked point () in order to remind to the user the current value of the **Level**.

## 3.16 Annotations

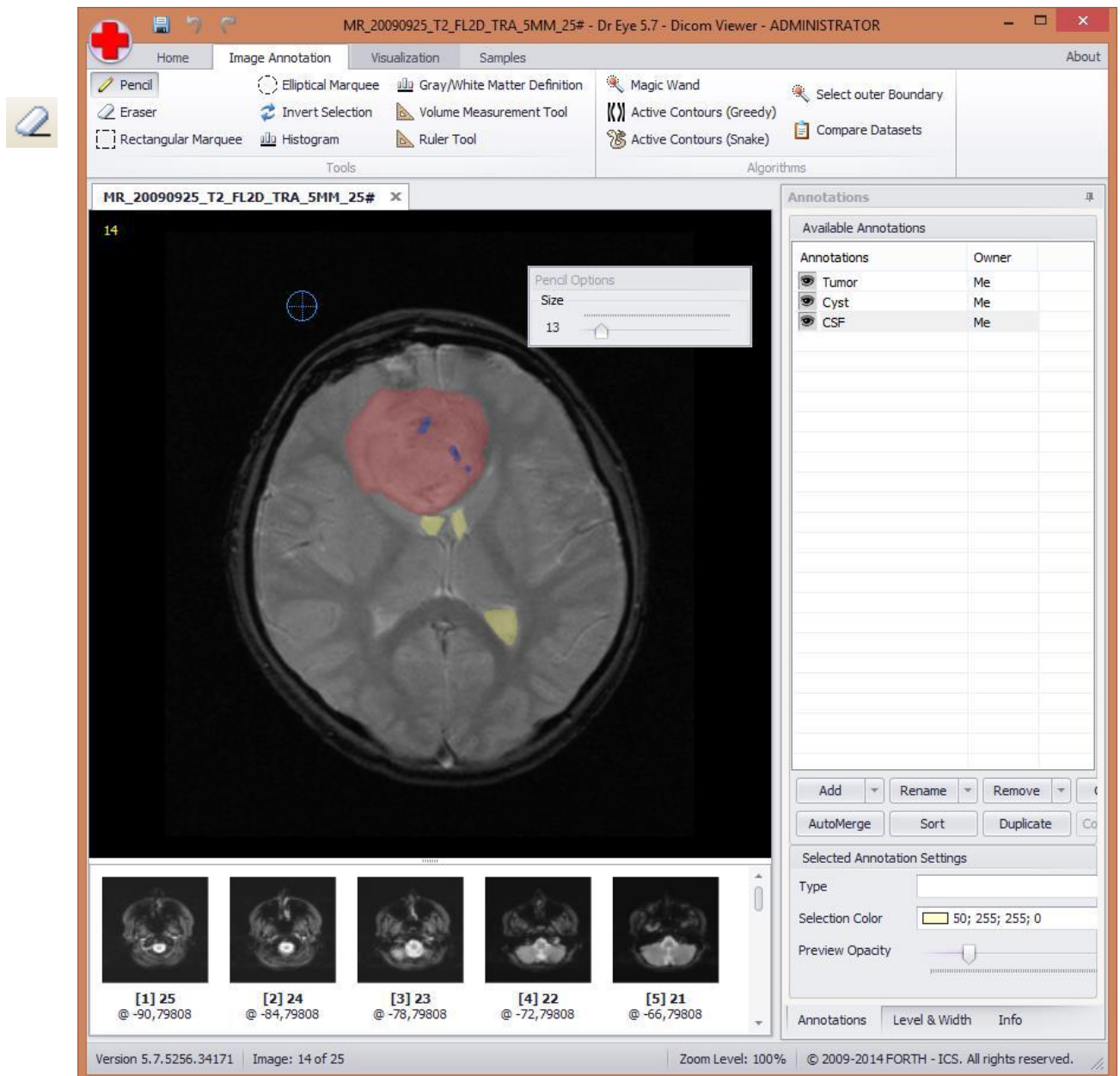
By clicking the **Annotations** tab (bottom right), two panels appear at the right side of the main window. The **Available Annotations** panel & the **Selected Annotation Settings** panel.



At the Available Annotations panel we can see the list of annotations for the current DICOM image in display. As we can see from the image above, at the current DICOM image, the user has created 3 annotation layers.

### 3.16.1 Adjusting a Selection using the Pencil tool.

If you have not already done so, click on the **Image Annotation** menu. Enable the **Pencil** tool by clicking the corresponding icon. You will notice that the cursor of the mouse has changed into a crosshair. Hold down the left mouse button and drag the mouse, a line will be drawn. The drawn line has the color defined at the **Selection Color** box. If you prefer to use another color click the **Selection Color** box and pick your color, from one of the three available tabs.

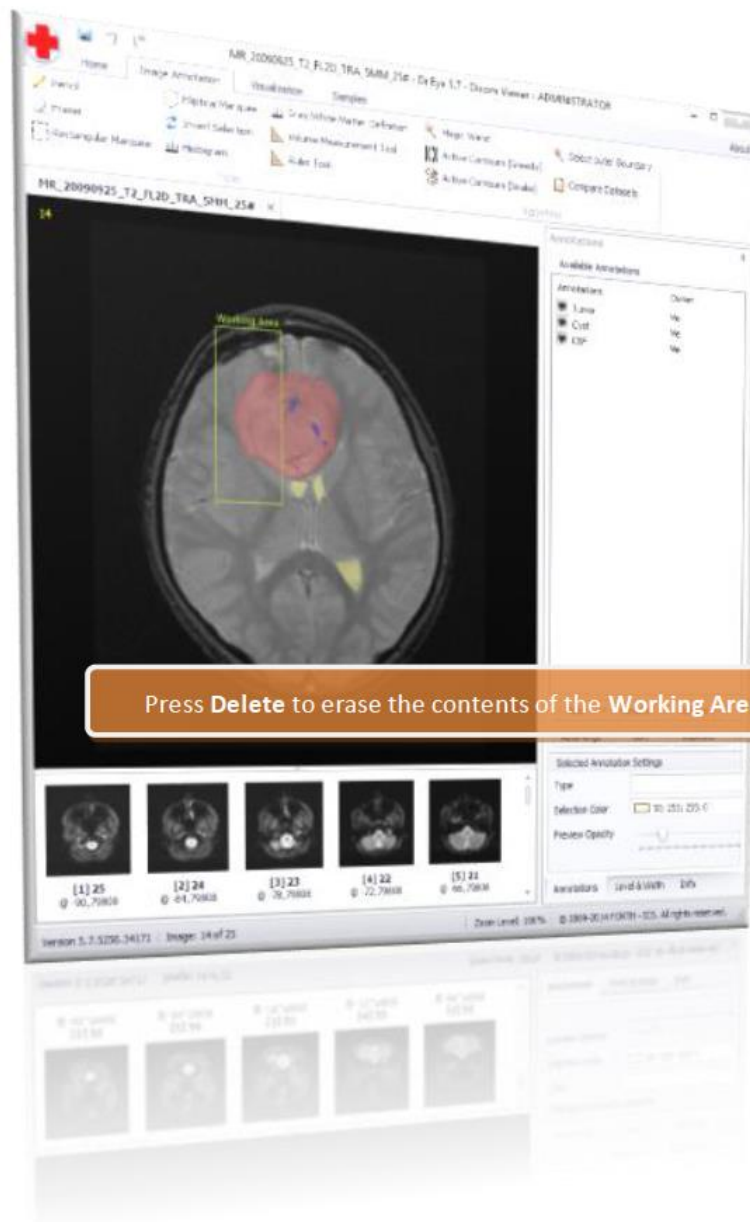


### 3.16.2 Erasing Selection Points using the Eraser tool.

If you want to delete a part of an annotation you can use the **Eraser** tool. Click on the tool, press down the mouse button where you want to start erasing and drag the mouse over the area you want to delete.



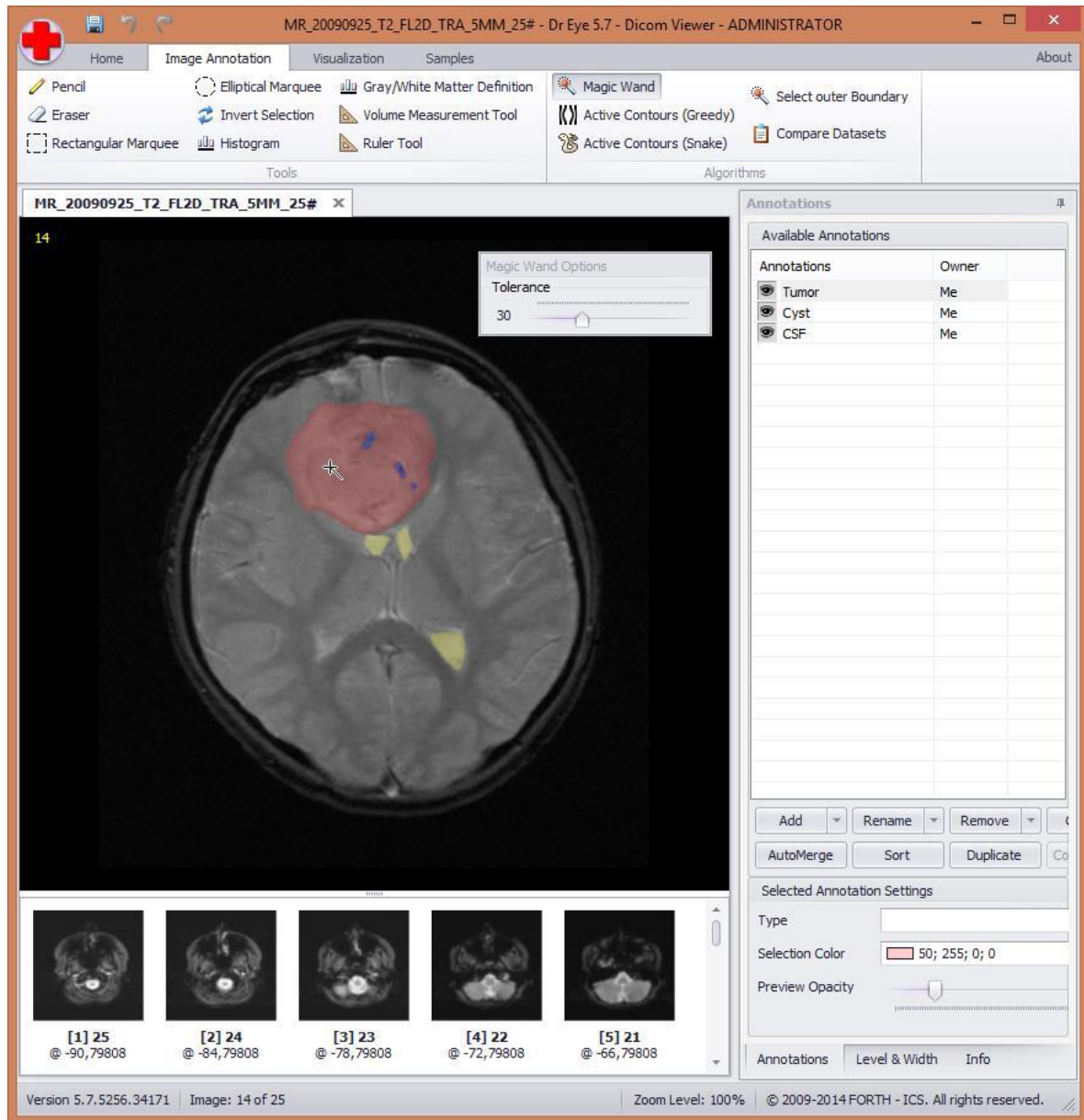
**Quick Tip:** The fastest way to delete a portion of an annotation, is by pressing the **Right** mouse button and **dragging** the mouse. A yellow rectangular, with "**Working Area**" text written at the left top corner of it, is displayed. Release the right mouse button and press the **Delete** key. Any annotation part inside the "**Working Area**" rectangle is deleted.



### 3.16.3 Make a Selection using the Magic Wand tool

The **Magic Wand** tool allows you to select an area of an image based on color similarities between pixels. Select the tool and click the image in an area which you want to select. To well define the selection, adjust the **Tolerance** slider, located at the floating **Magic Wand Options** window. The **Tolerance** value ranges between 1 and 100. A lower value selects fewer colors similar to the pixel

you click with the **Magic Wand** tool (smaller selection). A higher value selects a broader range of colors (larger selection).

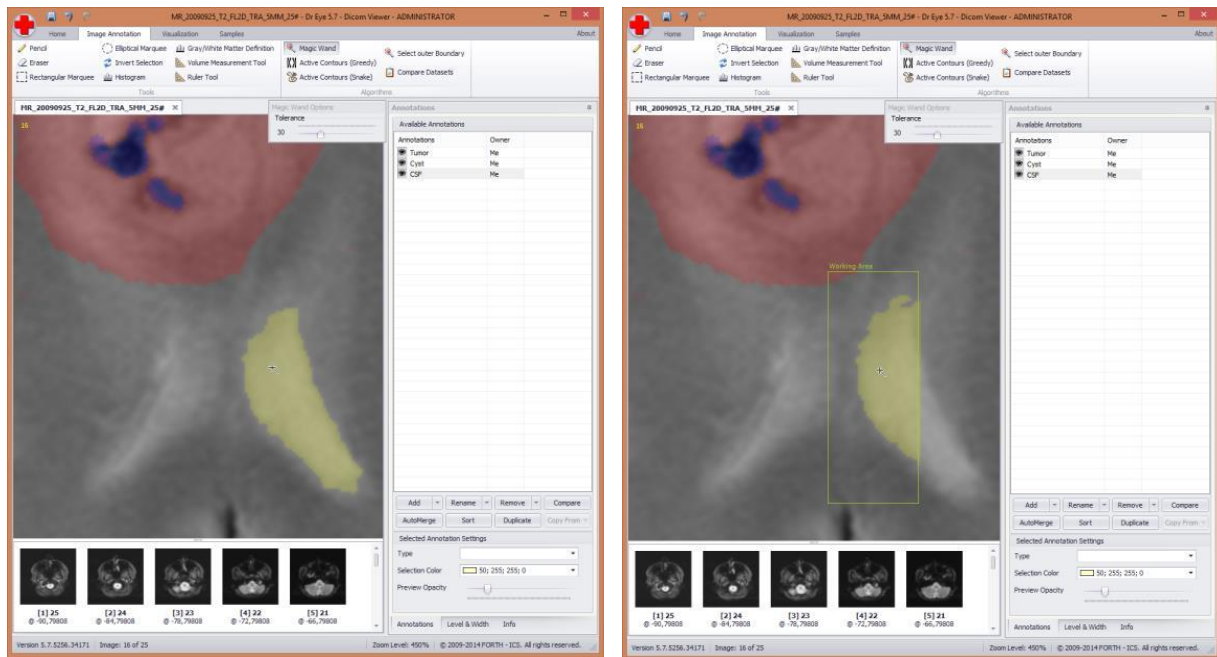


*Selected part of a DICOM image using the **Magic Wand** tool.*

The **Magic Wand** tool has a probability to choose a larger area than desired. In this case, you may want to limit the area that the tool works. Set a **Working Area** holding the right mouse button down and try again.

The Magic Wand selects the area of pixels defined by the Tolerance value, but this time is restricted inside the Working Area, as shown in the following images.

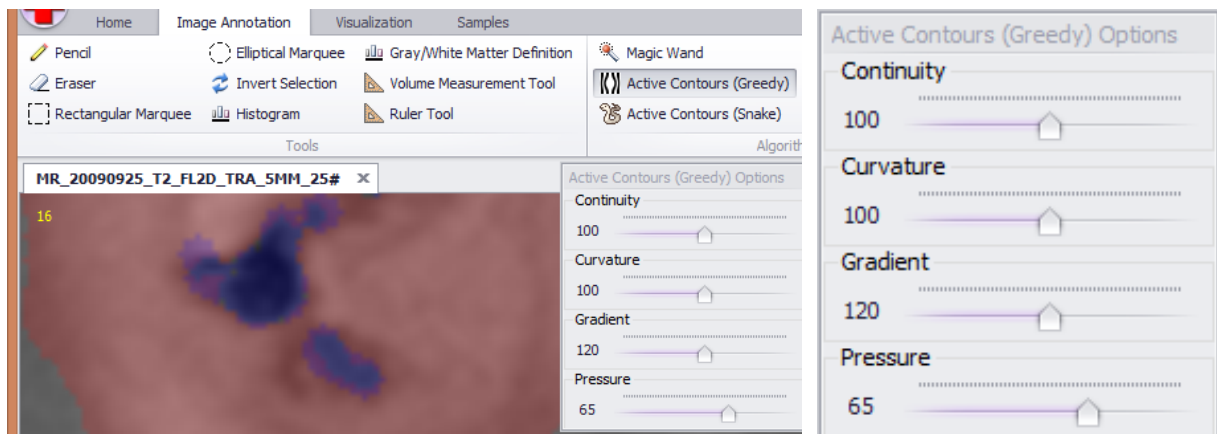




*Selected region: Working Area is not defined.*

*Selected region: Working Area is defined.*

### 3.16.4 Make a Selection using the Active Contours Tool (Greedy Algorithm)



*The greedy contour tool activated*

*The tool's options*

The **Contour 1** tool has four basic parameters. **Continuity** (varies from 0 to 200), **Curvature** (varies from 0 to 200), **Gradient** (varies from 0 to 240) and **Pressure** (varies from 0 to 100).

In order to annotate an area using the tool, press the left mouse button, while the mouse cursor is located inside the area of interest, and drag it. This creates an ellipse with a green border, which must be well located inside the area of interest. Release the mouse and press the space key. **Every time the space key is pressed, the ellipse expands in order to include a larger area of interest.** The tool usually requires multiple keystrokes of the space key, in order to provide an adequate annotated area.

If a part of the ellipse is outside of the area of interest, the tool will not function appropriately.

In order to deselect the semi-automatic annotated area just click once with the mouse.

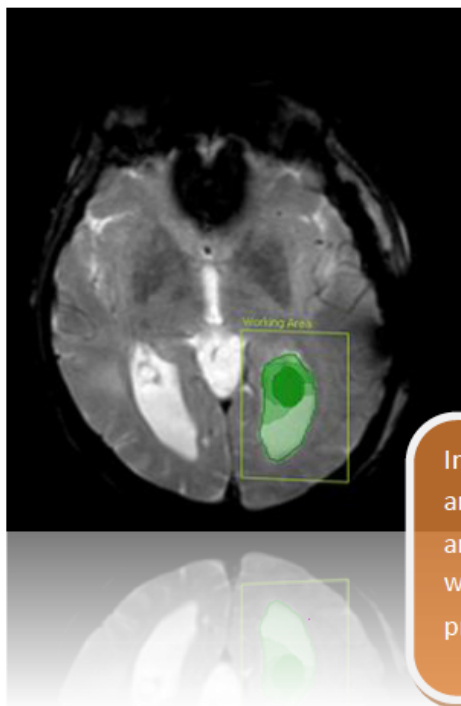
If the selected area is satisfactory, press the **Enter** key in order to accept the selection as annotation (in that case the ellipse with the green border transforms to a red selected area).

In order to annotate an area using the tool, press the left mouse button, while the mouse cursor is located inside the area of interest, and drag it. This creates an ellipse with a green border, which must be well located inside the area of interest. Release the mouse and press the space key. **Every time the space key is pressed, the ellipse expands in order to include a larger area of interest.** The tool usually requires multiple keystrokes of the space key, in order to provide an adequate annotated area.

If a part of the ellipse is outside of the area of interest, the tool will not function appropriately.

In order to deselect the semi-automatic annotated area just click once with the mouse.

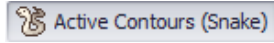
If the selected area is satisfactory, press the **Enter** key in order to accept the selection as annotation (in that case the ellipse with the green border transforms to a red selected area).



In the image beside is displayed the evolution of the annotated area for several keystrokes of the space key. The area of initialization is the dark green ellipse in the center, while the light green area is the result of the annotation process using the Contour 1 tool.

### 3.16.5 Make a Selection using the Active Contours Tool (Moving Snake Algorithm)

The tool implements the active contours algorithm. This algorithm requires from the user to draw an ellipse inside the tumor area. This user-defined ellipse forms an elastic contour, on which a force is applied from inside out and forces the contour to expand towards the tumor boundaries. The contour is formed to be attracted by significant edges, thus, as it expands it fits the tumor boundaries.



The user adjusts a single parameter in order to change the snake's behavior during its evolution and control the result.

The tool has only one parameter, the **Force**, which varies from 0.00 to 1.00.

**Force:** This parameter is the force that pushes the snake to expand outwards. The larger its value, the greater the force that is applied on the snake. **Be careful:** if this parameter is set to a very low value, the contour might not be able to reach the tumor boundaries. On the contrary, if its value is too large, it might overpass the tumor and expand out of it.

In order to annotate an area using the tool, press the left mouse button, while the mouse cursor is located inside the area of interest, and drag it. This creates an ellipse with a green border, which must be well located inside the area of interest. Release the mouse and press the space key **once**. **Every time the space key is pressed, the ellipse expands in order to include the entire area of interest.** The tool usually requires one press of the space key, in order to provide an adequate annotated area.

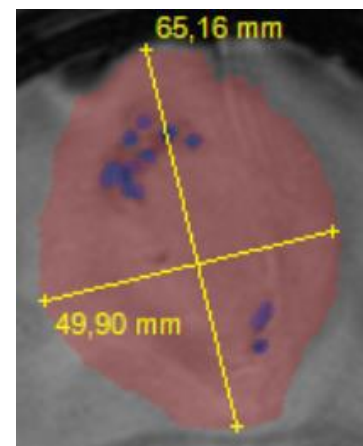
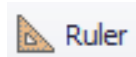
If a part of the ellipse is outside of the area of interest, the tool will not function appropriately.

In order to deselect the semi-automatic annotated area just click once with the mouse.

If the selected area is satisfactory, press the **Enter** key in order to accept the selection as annotation (in that case the ellipse with the green border transforms to a red selected area).

### 3.17 Ruler

The ruler tool allows the user to measure length between two points. In order to use the tool, press the left mouse button on the initial point, keep pressed and release it at the end point. Immediately the application computes the distance in mm. If you wish to measure another distance, repeat the process. You will notice that both measurements remain at the working view (screenshot). That happens because the software allows for multiple simultaneous measurements by default. If you wish to clear the measurements, press the **Delete** key or just click anywhere on the image.





### 3.18 Volume Measurement

The Volume Measurement tool allows the user to measure the spatial properties of a region of interest. In order to use the tool, just click on it. The tool uses the selected annotation layer of the



**Volume Measurement**

active image, and then it checks if other annotations with the

same name exist on the rest of the images of the opened series. If there are, then it uses the sum of the selected voxels from all the annotations with the same annotation name of the series, in order to compute the volume. The tool also counts the selected pixels of the active annotation, it calculates the surface they occupy, and it also displays relative information from the DICOM tags (Pixel Width, Pixel Height, Slice Thickness and Slice Spacing). All of the above information is presented in a floating window as shown in figure.

Volume Measurement Options	
Selected Annotation	
Label:	Tumor @ image with UID 14
Voxels (in slice):	11932
Voxels (in series):	71878
Area:	2407.848 mm <sup>2</sup>
Volume:	159552.832 mm <sup>3</sup>
Pixel Width:	0.449
Pixel Height:	0.449
Slice Thickness:	5.000
Slice Spacing:	6.000

In order to deactivate the tool just click on it again.

### 3.19 Select Outer Boundary

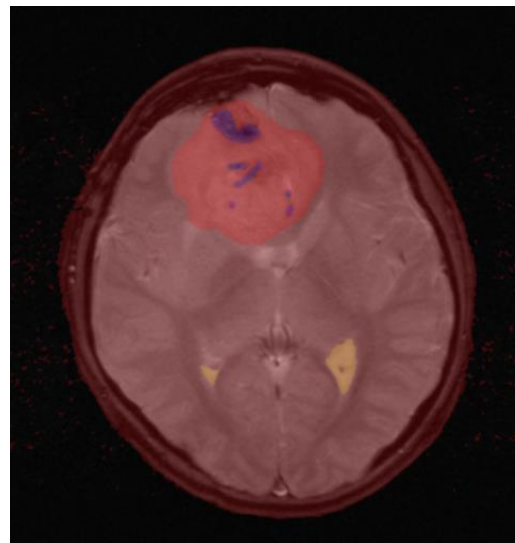
The tool creates a new annotation layer in every image of the series, named Boundary, and it selects approximately the head area including the skull (it was



**Select outer Boundary**

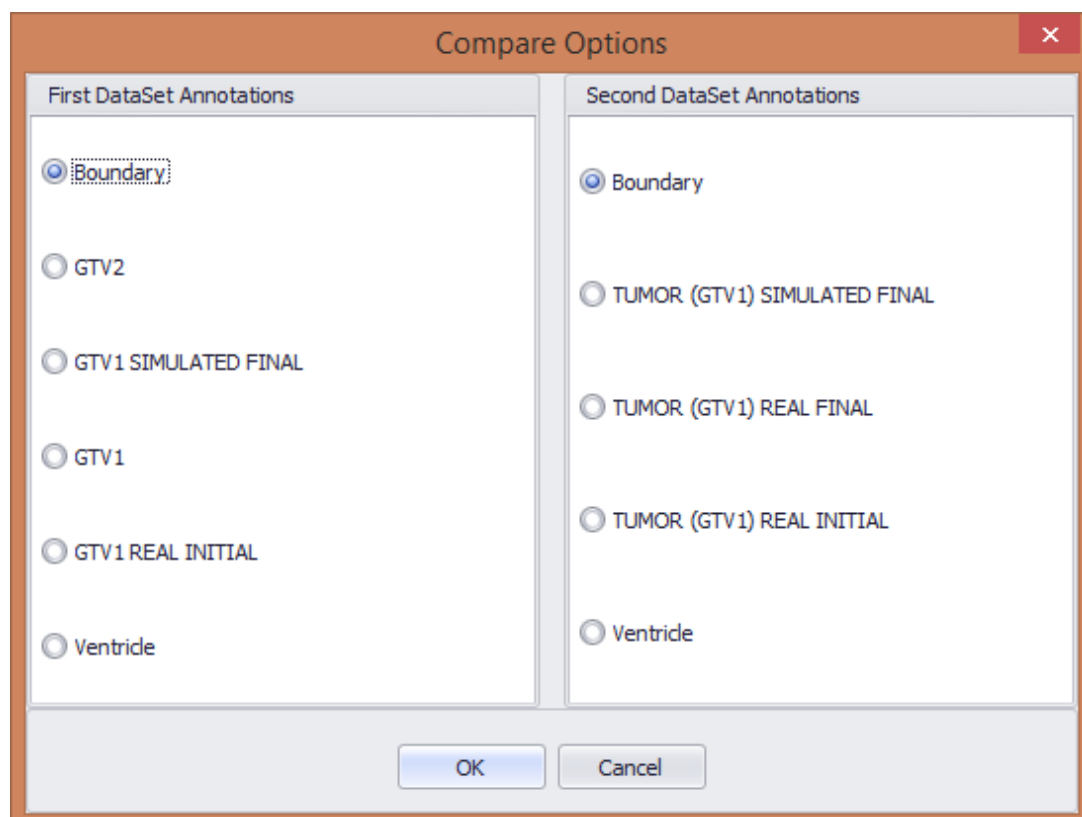
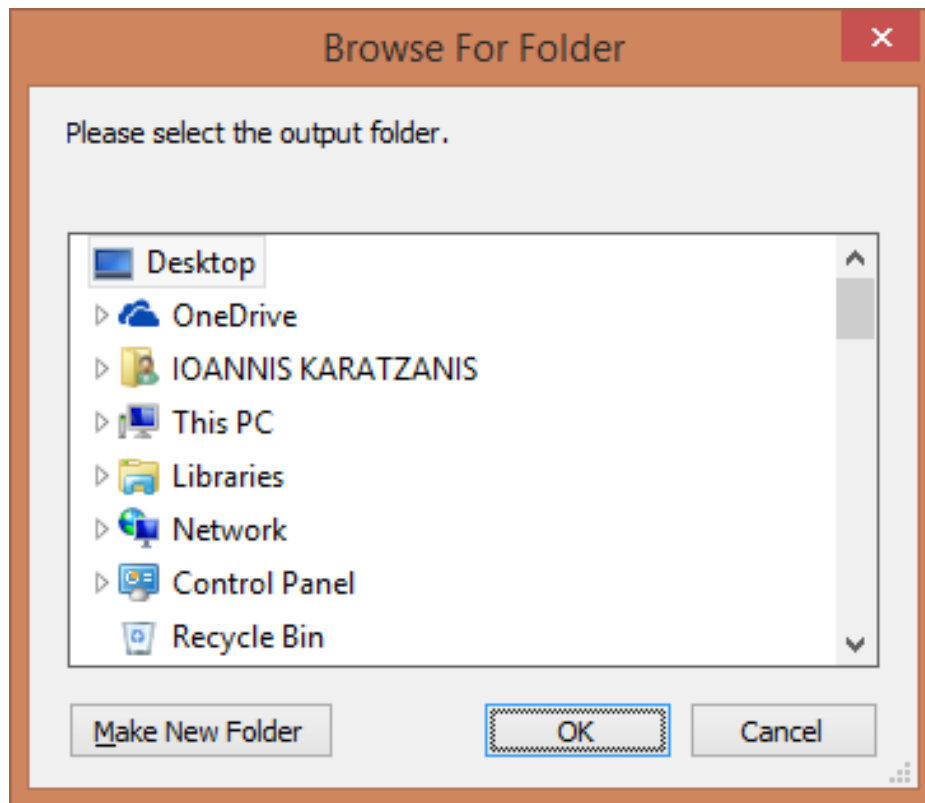
developed mainly for use with brain images). The tool might be

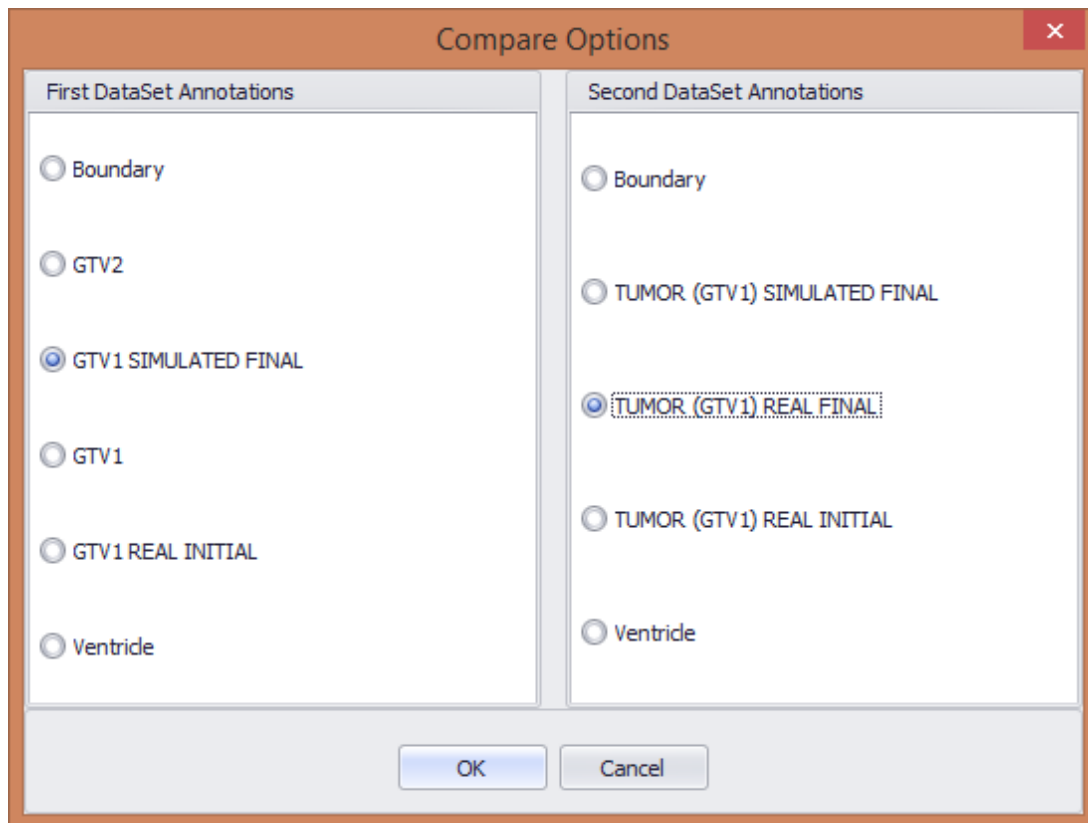
useful for all the cases where there is an "empty" outer area, and we want to select all the other portions of the image. The new annotation layers are called Boundary, because we can use them as boundaries for plugins performing simulations of tumor growth and need as input a mask defining the area of the image that has information. Usually some tweaking must be done, after the usage of the tool, as most of the times there is noise that must be removed (e.g. using the Eraser tool or by selecting and deleting areas).



### 3.20 Compare Datasets

This tool performs a comparison among two different instances of the same dataset, by comparing their annotation layers per image of the series. So for example if we have the same dataset within two different folders, where the one has annotated the initial stage of a tumor (defined by the clinician), and the other folder contains the same dataset but annotated by a plugin which simulates the evolution of the tumor after x days, we can open them together in the application. From there we can use the tool, which checks if the two series are the same (by comparing their DICOM tags) and if there are annotations in the two series with the same name. If the previous prerequisites are met, then a third tab is produced with annotations, which show the overlap or not of the two series. Upon these annotation layers, various analysis can be performed either using the native tools of the application or 3rd party plugins.

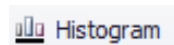




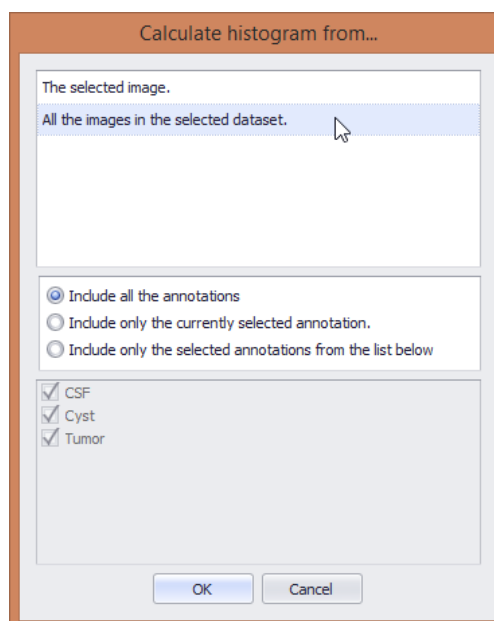
The folder is populated with images.

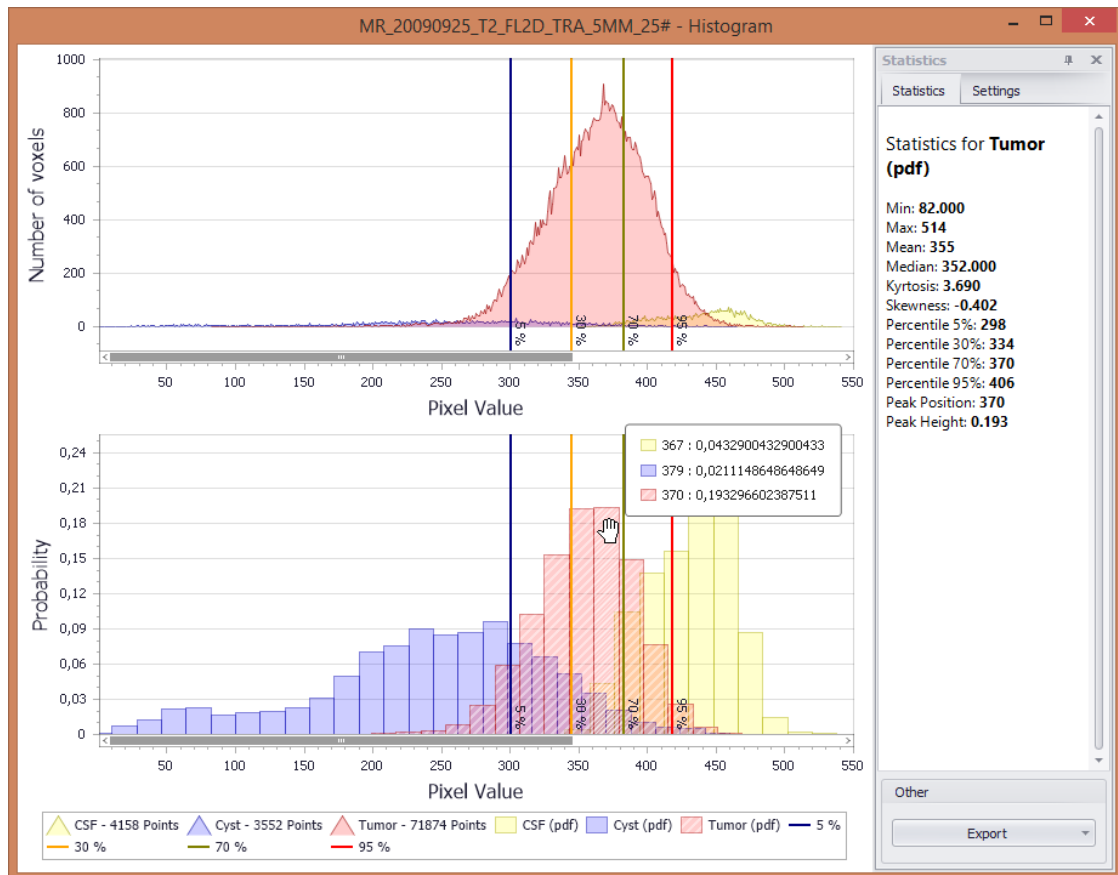
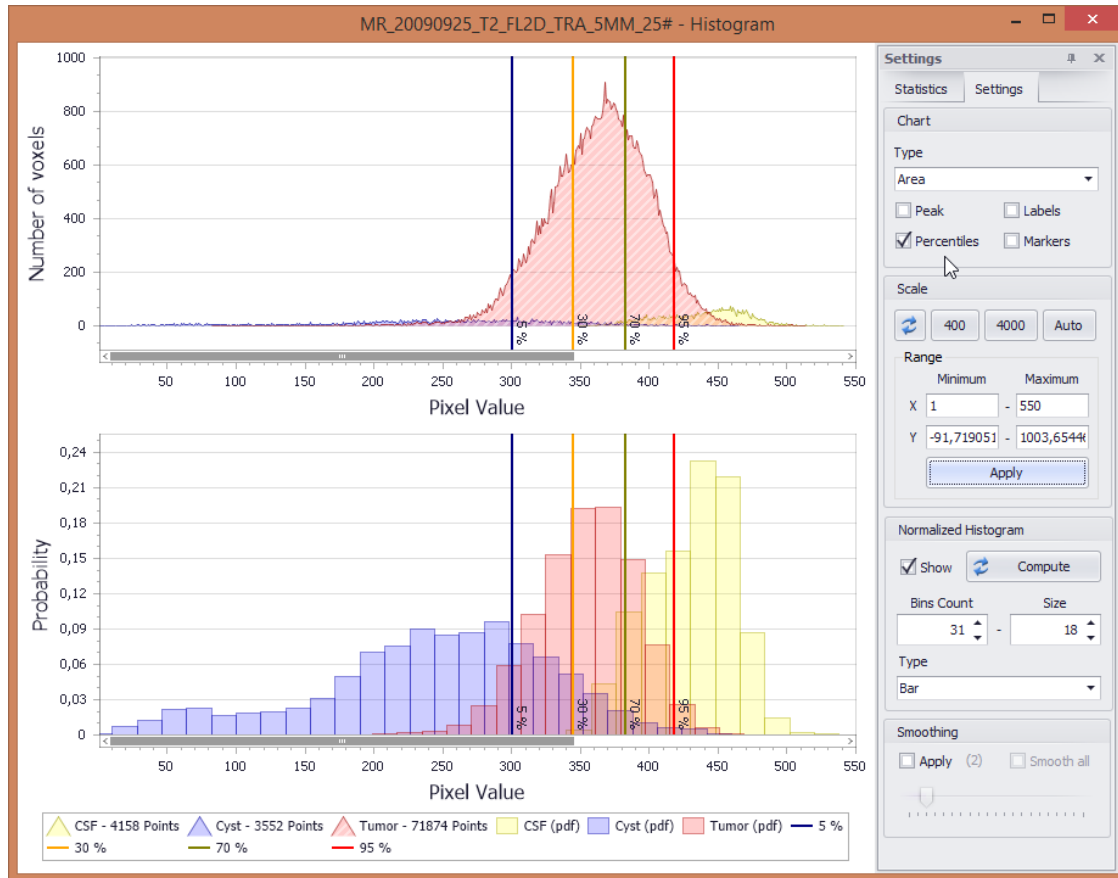
Open the folder from doctor eye.

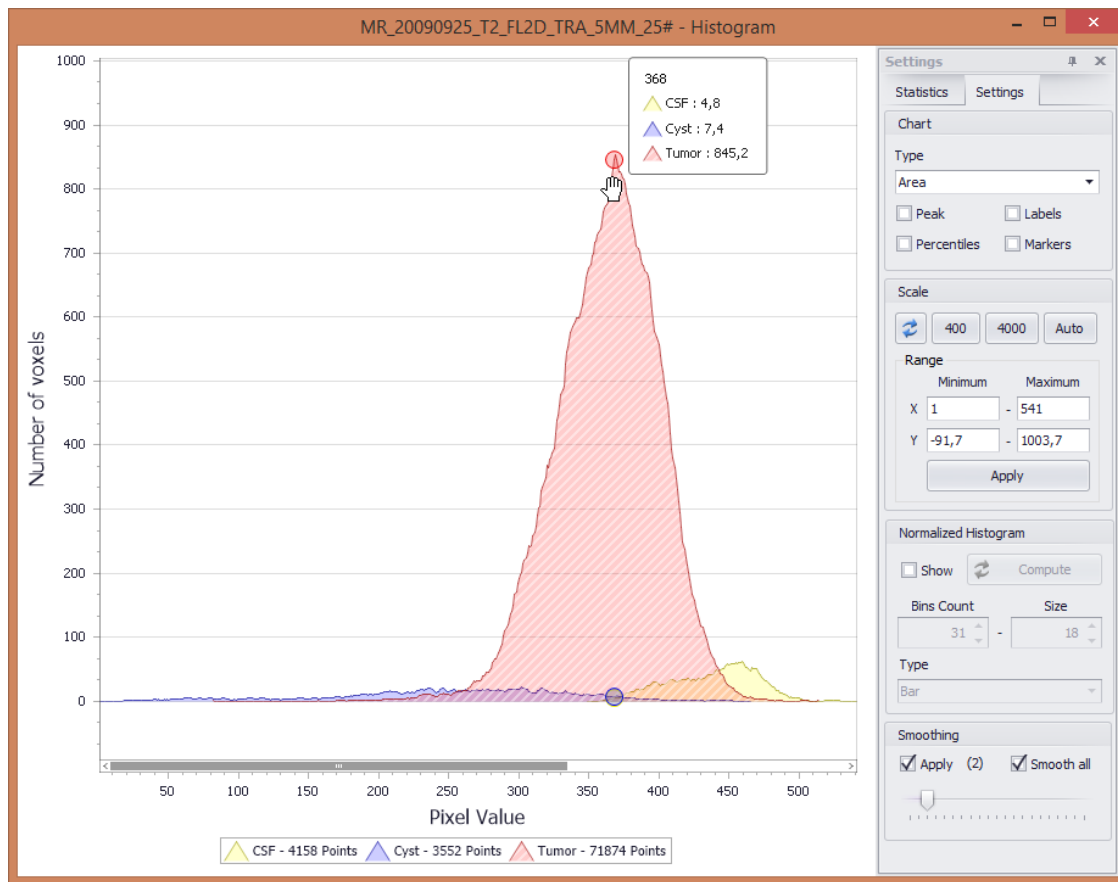
### 3.21 Histogram



The last tool of the group Selected Annotation Settings is the **Histogram** tool.







Using the histogram tool we manage to deselect undesired parts of the annotated area, thus improving the quality and the precision of the annotation

## 4 BraTumIA and brain segmentation

### 4.1 Overview

BraTumIA is a software tool for automatic brain tumor image analysis. It can segment the tumor including its sub-compartments from magnetic resonance images (MRI) of glioma patients. For this, it requires four different MRI sequences (T1, T1contrast, T2, FLAIR) as an input and it outputs volumetric information about the tumor and its sub-compartments (necrotic tissue, active enhancing tumor tissue, non-enhancing tumor tissue and edema). Additionally, the software can also segment healthy subcortical structures surrounding the tumor. Label maps of the segmented tissues and structures are available as an overlay on the original images.

The images are processed using a pipeline approach, where skull-stripping is performed first in order to generate a brain mask. Subsequently, all images are co-registered to ensure voxel-to-voxel correspondence between the different MRI sequences. Based on these registered images, a segmentation of the patient images into healthy and tumor tissues is done based on combined classification and regularization. This produces a label map and quantitative information about tissue volumes. Healthy subcortical structures are segmented using a deformable registration of an atlas to the patient image. Finally, the label maps can be transformed back into the original space of each image sequence so that they can be shown as an overlay on the original images.

The computation time for the complete pipeline depends on the processor and the amount of memory, on modern computers it should take around 5 minutes to process one patient.

Please be aware that BraTumIA is intended for scientific use only!

### 4.2 System Requirements and Installation

The program runs on Windows 7 or Windows 8 (64bit version) with a minimum of 16 GB of RAM memory (more is recommended). Start the Windows installer program and choose a location to install the program on your computer or extract the files, which are in the zip folder into a directory of your choice (approximately 2 GB of hard disk space are required).

### 4.3 User Manual

The core program is organized as a pipeline where skull-stripping, multi-modal registration, tissue classification and segmentation of subcortical structures are carried out sequentially. From the main window, the user has to load the image data first, then process it, before he can visualize and analyze the results.

#### 4.3.1 The main window

The main window of BraTumIA contains menu buttons for loading and unloading images at the top. On the left panel, the user can find different options for processing and visualizing the data. This panel also contains basic patient information, information about the currently ongoing actions and quantitative information about the segmented tumor volumes.

The largest part of the main window contains four visualization sub-windows, where the image data and the label overlay are shown. The different sub-windows can either show different MRI sequences or one sequence in different viewing orientations.



### 4.3.2 Loading the data

The user can start to load the patient images by clicking on the *Load* button and add the sequences. He has to choose the location of the *T1*, *T1contrast*, *T2* and *FLAIR* images. BraTumIA supports volumetric images in the meta image format (.mha), the Nifti format (.nii) and Dicom series (.dcm). If the format is Dicom, the different modalities have to be located in different folders and the location of the folder for each modality has to be selected. The directory tree has to be selected in the left sub-window and the final folder/image in the right sub-window.

In addition to the four MRI sequences, it is possible to specify a *template* image, to which all other images will be registered. This can be e.g. a CT of the same patient (so that the segmentation can be overlaid on the patient CT image) or an MRI atlas image (for normalization in a standard space). In longitudinal patient studies, it can also be useful to use the T1contrast image of the first baseline scan of this patient as a reference template for all acquisition time points in order to ensure voxel-to-voxel correspondence and allow for direct comparisons across different time points. If a template for spatial normalization is not required, then this field can be left empty.

Finally, an *output* folder has to be selected where all the results will be stored.

**Add Patient**

**Set Modalities:**

Set T1 path T1

Set T1c path T1c

Set T2 path T2

Set Flair path Flair

Same as T1c Template

**Output Folder:**

Set Output folder Output

LOAD **Surgery Da**  (e.g. 21.12.2013) and press ENTER

### 4.3.3 Processing the data

For the processing, the user can call each module separately (*skull-stripping*, *multi-modal registration*, *classification*) or he can press the *All@Once* button for a completely automatic processing in the *Do Seg* tab, located on the left panel. The *classification* button and also the *All@Once* button will perform both segmentation of tissues and subcortical structures. The progress can be seen in the command line window.





Interface

Patient Nam Age: Sex:  
G-25 68

Acquisition Da 12.09.2008

Modality:

☐ T1 ☐ T1c  
☒ ALL  
☐ Flair ☐ T2

☐ Register  
☐ Classifier ☒ MultiSc

Segmentation:

See SEG Do SEG

SkullStripping  
MultiModalReg  
Classification  
All@Once

☐ Apply for all Series

Segmentation Table

Patier 1 / 1  
- +

Series 1 / 1  
- +

8  
Reading finished

#### 4.3.4 Visualizing and analyzing the results

The visualization sub-windows can be used in two ways: when *all* is ticked in the modality selection panel on the left, then all four modalities are displayed in clock-wise direction, starting with T1 on the top left, T1contrast top right, T2 bottom right and FLAIR bottom left. If only one specific modality is ticked, then this modality is displayed in axial, coronal and sagittal view in 3 sub-windows and the fourth sub-window shows the T1contrast image.

In the panel on the left, it is also possible to choose whether the *registered* version or the original version of the images should be displayed. The *Tissues* option allows the user to choose if the segmented label image should be shown as a color overlay over the grayscale images and the *Structures* options will show the subcortical Structures as an overlay. In the *Show Seg* menu the user

can choose which modalities should be overlaid with the color label map. Finally, when the multi-scroll box is ticked, it is possible to scroll through all modalities simultaneously (this makes only sense for the registered images), otherwise only the sub-window under the cursor is active.

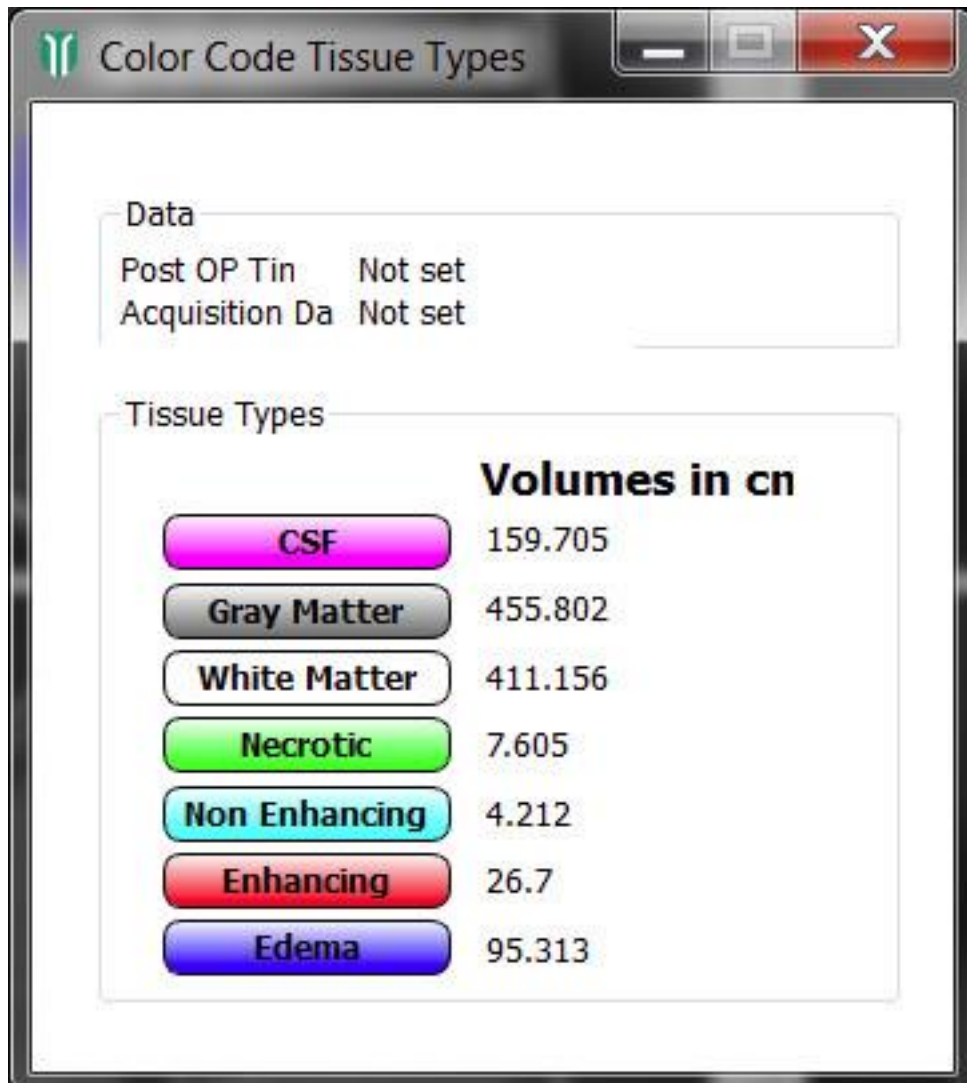


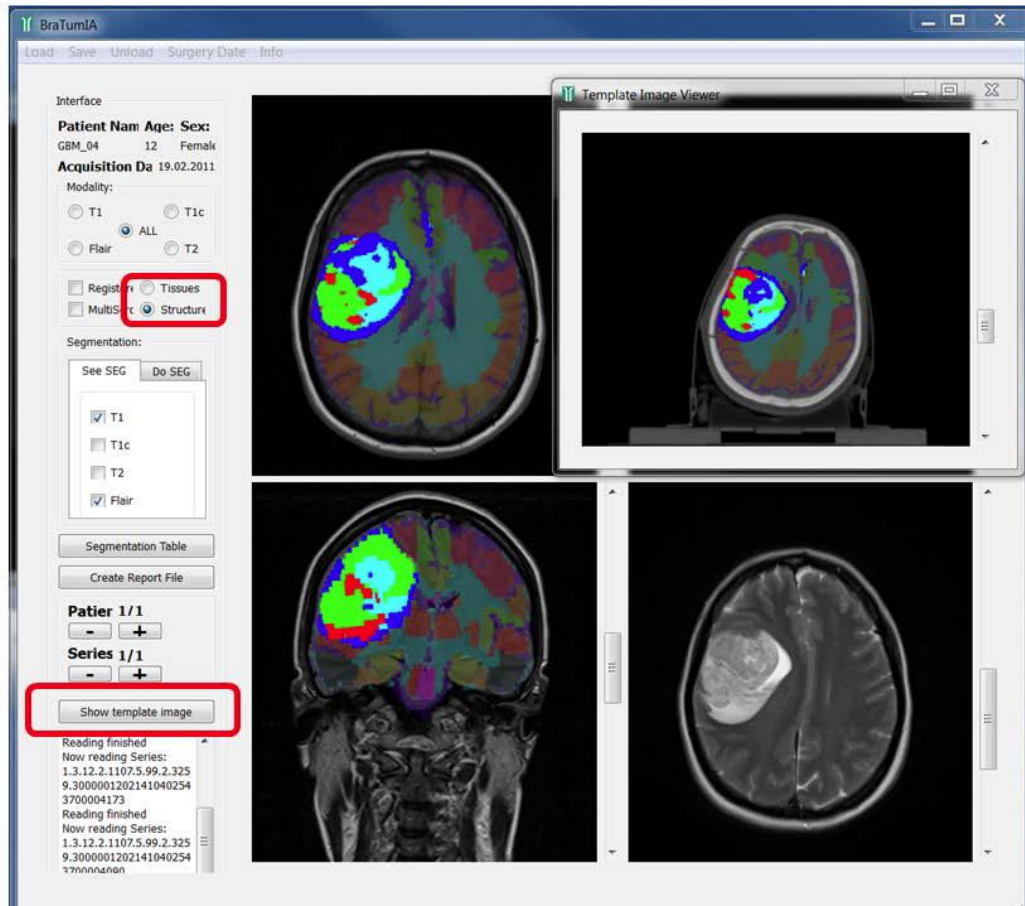
The segmentation table is a pop-up window that shows the volumes for each segmented tissue compartment. From this window it is also possible to switch on and off certain layers of the color label overlay by simply clicking on the respective tissue.

When the mouse cursor is located above a sub-window, additional activities are possible: Scrolling through the slices can be achieved with the scrolling wheel of the mouse or the scroll-bar on the right. When pressing the left mouse button and moving to the left and right or up and down, windowing and contrast of the image can be adjusted. Zooming is possible by pressing the right mouse button and moving up or down. The keyboard shortcut *shift + r* can be used to reset the current sub-window.

By pressing the *Create Report File* button, a .csv file is created that contains a longitudinal volumetric analysis of the active patient. It is stored in the output folder of the first baseline scan.

If the show template window button is clicked, the template image is shown in a separate pop-up window. The template image can also be overlaid with the segmentation results of tissues or structures if the relevant buttons are ticked.





#### 4.3.5 Locating the data on disk for external use

All the results are stored in a folder structure, which is located in the output directory that has been chosen by the user when loading the data.

The *classification* folder and the *structures* folder contain the label image in the registered image space, plus the label images which have been transformed back into the original space of each modality (T1, T1contrast, T2, FLAIR, template) in .mha format. If the input images were in Dicom format, this folder also contains all the label output images in Dicom format, so that they can be uploaded to a PACS system for further use. Additionally, the *classification* folder contains a report file in .txt format, listing the segmentation volumes for all the healthy and pathologic tissue sub-compartments and also the conventional 2D RANO diameter measurements, which are automatically extracted from the segmentation result. The subcortical structures which have been segmented, can be identified by the numbers they are assigned with. The subcorticalStructures.txt file in the *structures* folder provides information which structure is represented by which number.

The *originalFiles* folder contains the original input files (T1, T1contrast, T2, FLAIR, template) in .mha format. For research purposes this format can be handled more easily than Dicom stacks.

The *Registration* folder contains all image sequences after registration and skull-stripping in .mha format. It also contains the transformation parameters, which have been used for each sequence in the .tfm files.

The *SkullStripped* folder contains the brain mask of the T1contrast image, plus the skull-stripped T1contrast image in .mha format.

## 4.4 Known Issues

- Possible problems with tumors at the skull border (due to skull-stripping inaccuracies)
- Possible problems with pediatric patients
- Not optimized for post-operative images yet
- In general, the algorithm tends to over-segment tumor (more false positives than false negatives, especially edema in infratentorial regions)
- Better performance on high-grade gliomas than low-grade gliomas
- The accuracy of the subcortical structure segmentation has not been carefully evaluated yet.

## 4.5 Scientific Background

Brain tumor segmentation is a difficult task and despite a vast amount of scientific literature [1], there are only very few tools that can be used in a clinical context. BraTumIA is a research tool that aims at bridging this gap between science and clinics. For this, it builds on experience that was previously gained with the Doctor-No suite [2]. It allows clinicians to perform tumor segmentation and volumetry as suggested by the RANO group [3] in addition to segmentation of subcortical structures. BraTumIA has recently been evaluated in a clinical study [4].

The complete functionality is integrated into a graphical user interface [5] that is easy to handle for radiologists. All the computation and visualization algorithms are implemented in C++ using ITK [6], VTK [7] and Qt [8]. The skull-stripping is based on [9], whereas the registration is a standard rigid registration with mutual information similarity metric which can handle different modalities [10], [11]. The core of the program is the tissue segmentation method, which is based on a machine learning approach for integrated classification and regularization [12], [13], [14]. The segmentation method which is integrated in BraTumIA won a Kitware award at the MICCAI BraTS 2012 challenge<sup>3</sup> and an award from the National Cancer Institute at the MICCAI BraTS 2013 challenge<sup>4</sup> for being among the best performing methods for brain tumor segmentation [15]. The segmentation of subcortical structures is based on a simplified version of [16], where an atlas [17] is non-rigidly registered to the patient image (in contrast to [16] no tumor growth model is used here).

The definition of the four different tumor sub-compartments follows the VASARI guidelines of the National Cancer Institute of the American NIH [18].

## 4.6 How to cite BraTumIA

If you use BraTumIA, please cite the following publication:

N. Porz, S. Bauer, A. Pica, P. Schucht, J. Beck, R. K. Verma, J. Slotboom, M. Reyes, and R. Wiest, "Multi-Modal Glioblastoma Segmentation: Man versus Machine," *PLoS One*, vol. 9, no. 5, p. e96873, May 2014.

This handbook can be referred to as:

S. Bauer, T. Fejes, R. Meier, M. Reyes, J. Slotboom, N. Porz, A. Pica, and R. Wiest, "BraTumIA - A software tool for automatic Brain Tumor Image Analysis," 2013.

<sup>3</sup> <http://www2.imm.dtu.dk/projects/BRATS2012/>

<sup>4</sup> <http://martinos.org/rtim/miccai2013/>

## 4.7 Acknowledgements

The development of BraTumIA was funded by grants from different institutions:

- EU projects ContraCancrum and CHIC
- Swiss Institute for Computer Assisted Surgery (SICAS)
- Bernese Cancer League
- Swiss Cancer League
- Swiss National Science Foundation

## References

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## 5 CCGVis and volume rendering

### 5.1 Overview

This manual presents a detailed function description of CCGVis specially for CHIC users. The aim of CCGVis is to provide relevant researchers a tailored tool to interactively view and analyse the progress of the tumour as well as simulation predictions of the proposed treatment. It provides functions that cannot be fully satisfied by existing software and enables the users to investigate tumour development and treatment interactively and to gain a more intuitive and comprehensive understanding of the tumour size, shape, position and composition at different time points. For visualisation of the tumor data in CCGVis, slice views with highlighted tumour segmentation are useful to position tumours in 3D space. 3D surface and volume rendering of the segmented tumour is needed in order to display the shape of tumours and their relation to body tissues. To achieve the above, the following facilities are provided or are going to be provided:

- axis-aligned slice view
- arbitrary slice view
- isosurface rendering
- volume rendering
- time-varying visualisation (future work)
- 3D and 2D visualisation of simulation data.(future work)
- run as a DrEye plugin (future work)

### 5.2 User Interface

#### 5.2.1 Main User Interface

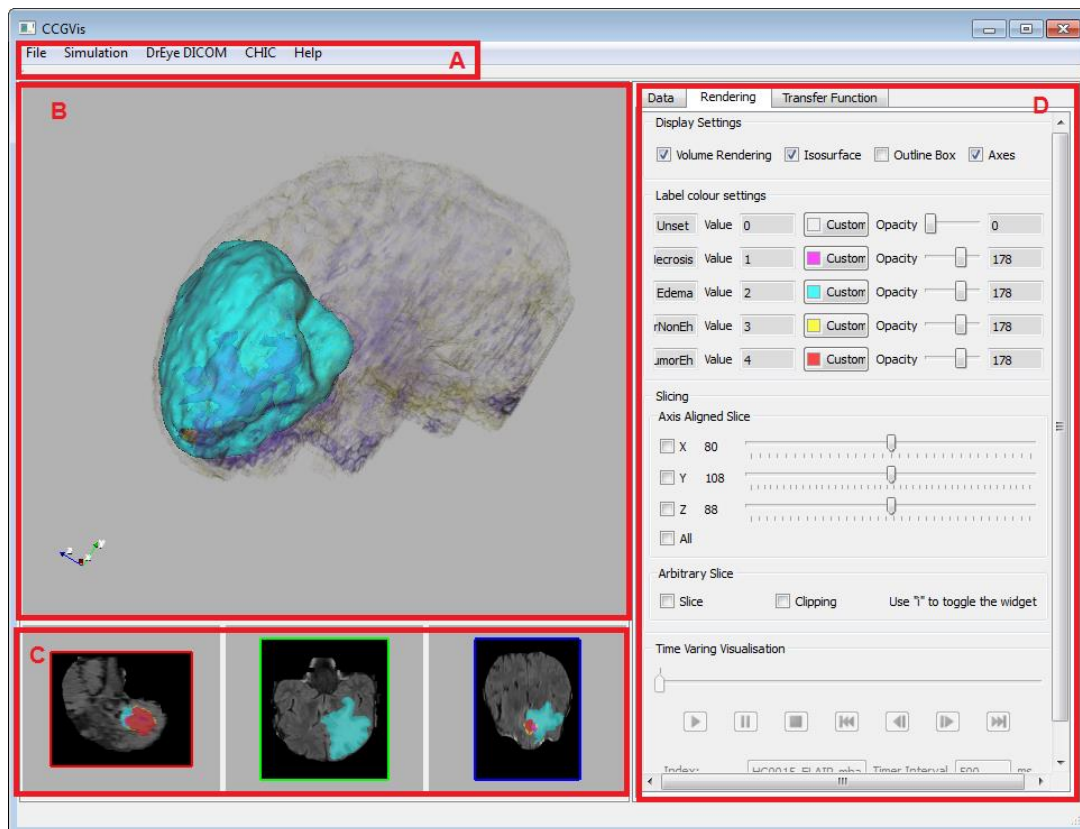


Figure 1 The Main User Interface: A: Menu, B: 3D Visualisation, C: Slice View, D: Control Panel

As shown in Figure 1, the main user interface of CCGVis is composed of the following parts:

- A: Menu

The menu provides a “CHIC” entry for CHIC users to load CHIC-specific data.

- B: 3D Visualisation

This area provides an interactive 3D visualisation of medical images as well as tumor segmentations. Slice views, isosurface and volume are all supported.

The user can use the mouse to interact with the 3D renderings in a common trackball style:

- Rotate : Left button dragging
- Pan : Middle button dragging
- Zoom : Right button dragging or wheel button

- C: Slice View

This provides standard X-Y-Z slice views of the medical images with tumor segmentation highlighted.

- D: Control Panel

The control panel provides detailed settings of the visualisation, e.g., rendering mode, segmentation colour settings, etc.

### 5.2.2 Control Panel

There are 3 tabs in the control panel: Data, Rendering and Transfer Function among which the Rendering tab is the most important. These tabs are introduced in the following sections.

### 5.2.2.1 Data Panel

Data
 Rendering
 Transfer Function

Data attributes
 

Dimension
 160
 216
 176

Spacing
 1
 1
 1

Origin
 -76.994
 -135.424
 -90.2048

Range
 0
 1610

Scalar Type
 SHORT

Size
 12,165,120

DICOM Tags
 

Tag ID	Description	Tag Contents
--------	-------------	--------------

Figure 2 : Data panel

As shown in Figure 2 the Data tab shows summary information of the medical volume data, such as dimensions, spacing, scalar type and range, etc. For CHIC users, DICOM tags are currently not available.

### 5.2.2.2 Rendering Panel

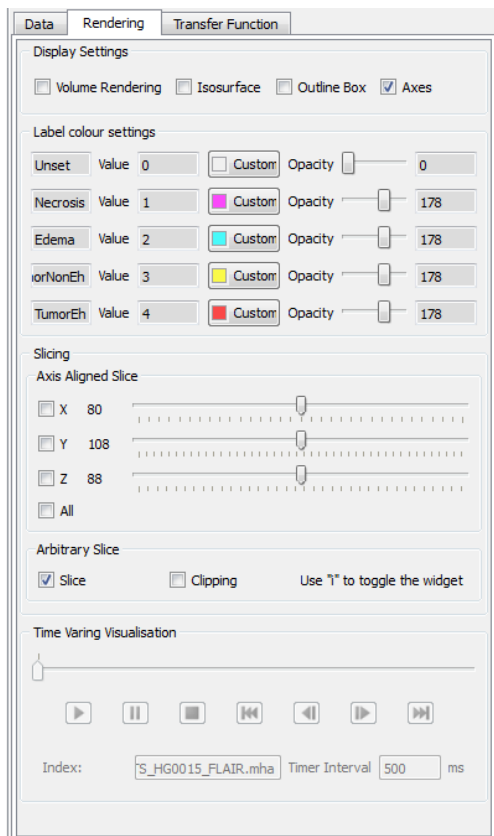


Figure 3 Rendering panel

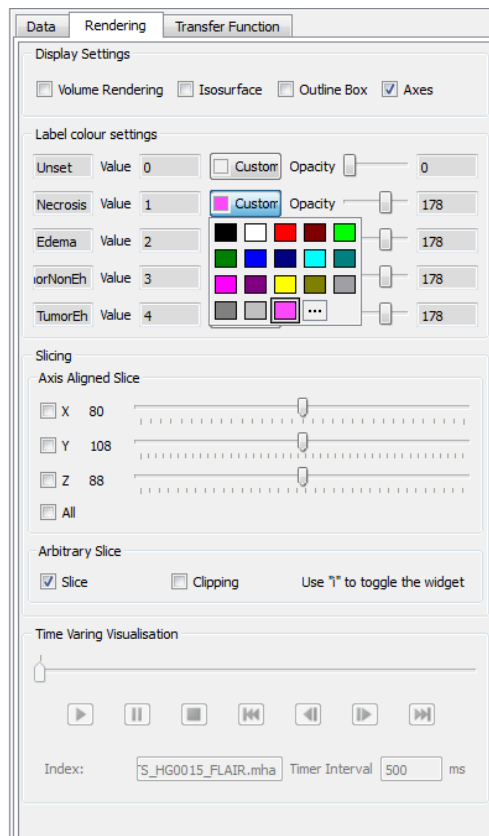


Figure 4 Set the colour of a layer.

As shown in Figure 3, the rendering panel includes the following sections:

- Display Settings

The user can turn on volume rendering and/or isosurface rendering here by checking the checkbox. The user can also choose to show the bounding box or the axis in the 3D visualisation view (B).

- Label Colour Settings

This section is used for setting the colours of different tumor segmentation layers. The user can choose different colours of a layer through a colour picker (as shown in Figure 4) and adjust the transparency of the layer.

- Slicing Settings

In the slicing setting section, there are two sub-sections: axis-aligned slice and arbitrary slice.

- Axis-aligned slice

In this axis-aligned slice section the user can turn on/off the display of the X, Y or Z slice by checking the checkbox. The user can also change the slice number by dragging the slider.

### ■ Arbitrary slice

In the arbitrary slice section, the user can turn on/off the display of the arbitrary slice. In addition the user can choose if this arbitrary slice is used for clipping. The interactive control of the arbitrary slice is described in section 3.3.

### ● Time-Varying Visualization

The time-varying visualization control section provides a video player like control for playing the animations. It will be supported in the future versions of CCGVis.

## 5.2.3 Transfer Function Editor

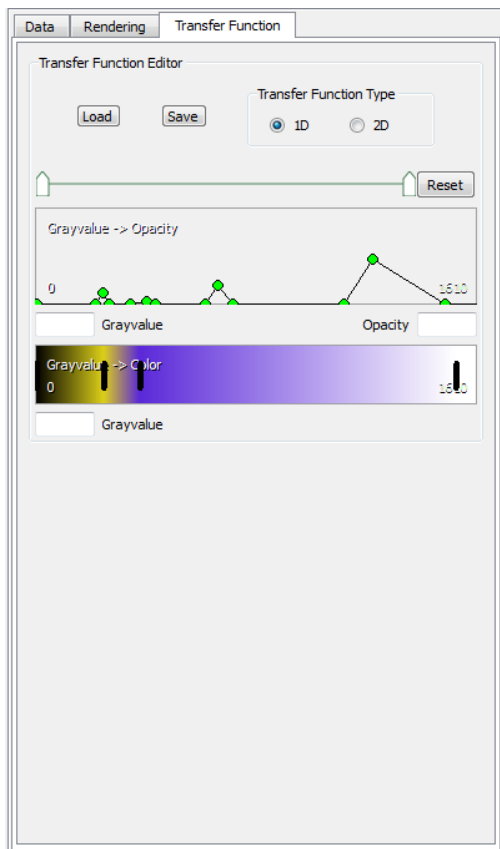


Figure 5 1D Transfer Function Setting

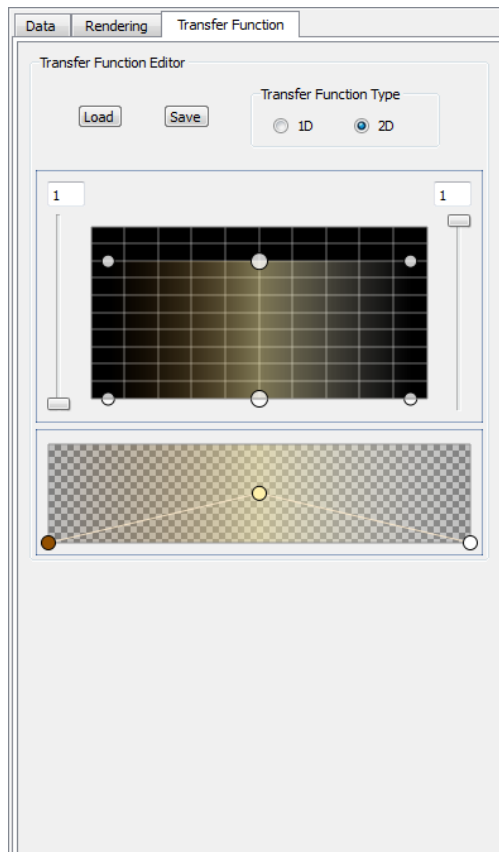


Figure 6 2D Transfer Function Setting

The transfer function tab is specially for volume rendering. There are 1D transfer function and 2D transfer function editors available. But in this document only the 1D transfer function editor is introduced. Details will be described in section 3.6.1.

## 5.3 Operations

### 5.3.1 Launching the program

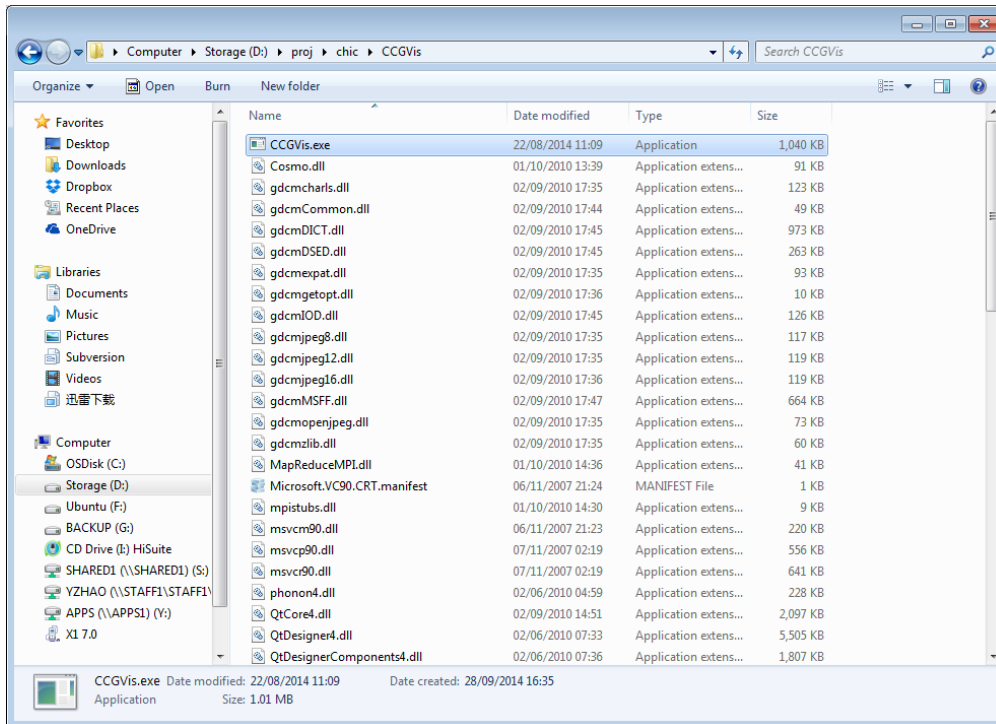


Figure 7 CCGVis folder

1. Unzip CCGVis.zip on Microsoft Windows, the unzipped folder contains CCGVis executable CCGVis.exe and all supporting dll files, as shown in Figure 7.
2. Double click CCGVis.exe to launch the program

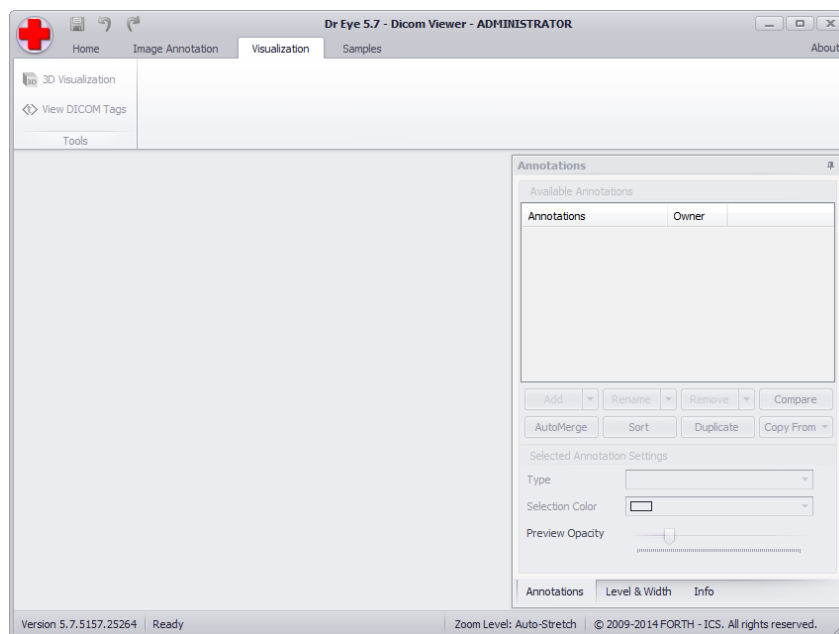


Figure 8 DrEye visualisation tab

In the future the program can also be made a DrEye plugin and started from DrEye. A new icon for CCGVis CHIC will appear under the visualization tab in DrEye whose interface is shown in Figure 8.

The interface of CCGVis after launching is shown in Figure 9.

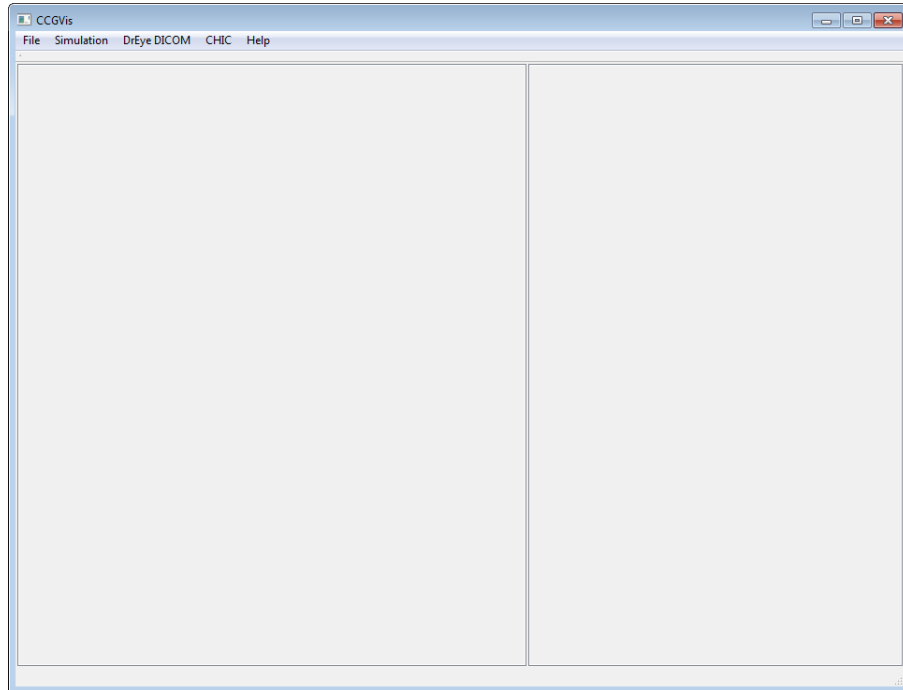


Figure 8 CCGVis after start-up

### 5.3.2 Loading Data

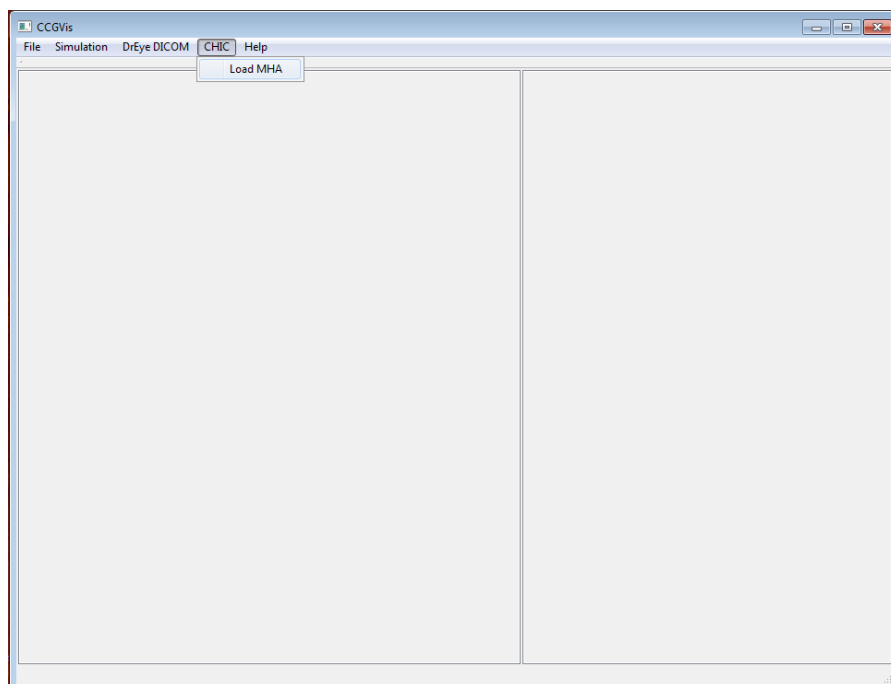


Figure 10 Menu CHIC->Load MHA



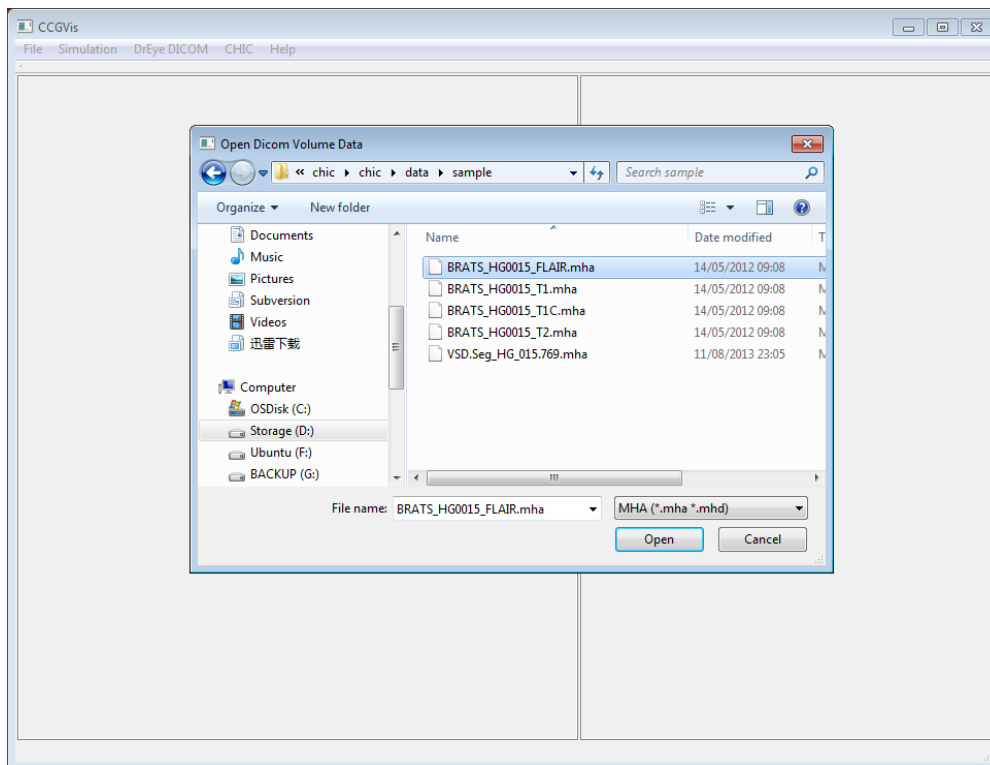


Figure 11 Selecting medical image data

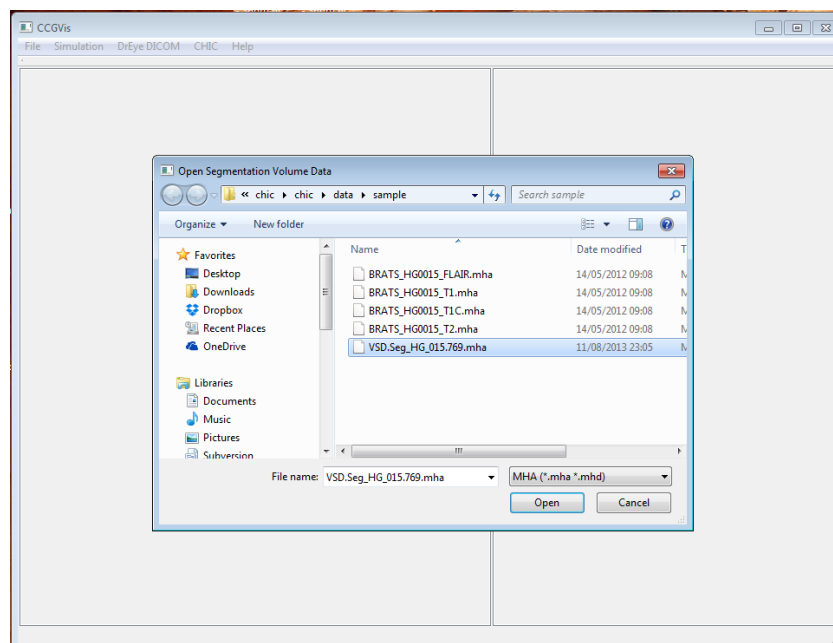


Figure 12 Selecting the segmentation file

Choose menu CHIC->Load MHA (Figure 10), a file dialogue will appear (Figure 11), then you need to choose the medical image file (.mha) and the segmentation file (.mha) separately.

The loading may take seconds to tens of seconds depending on the data size and the computer performance. The initial user interface shows an isosurface rendering similar to Figure 13.

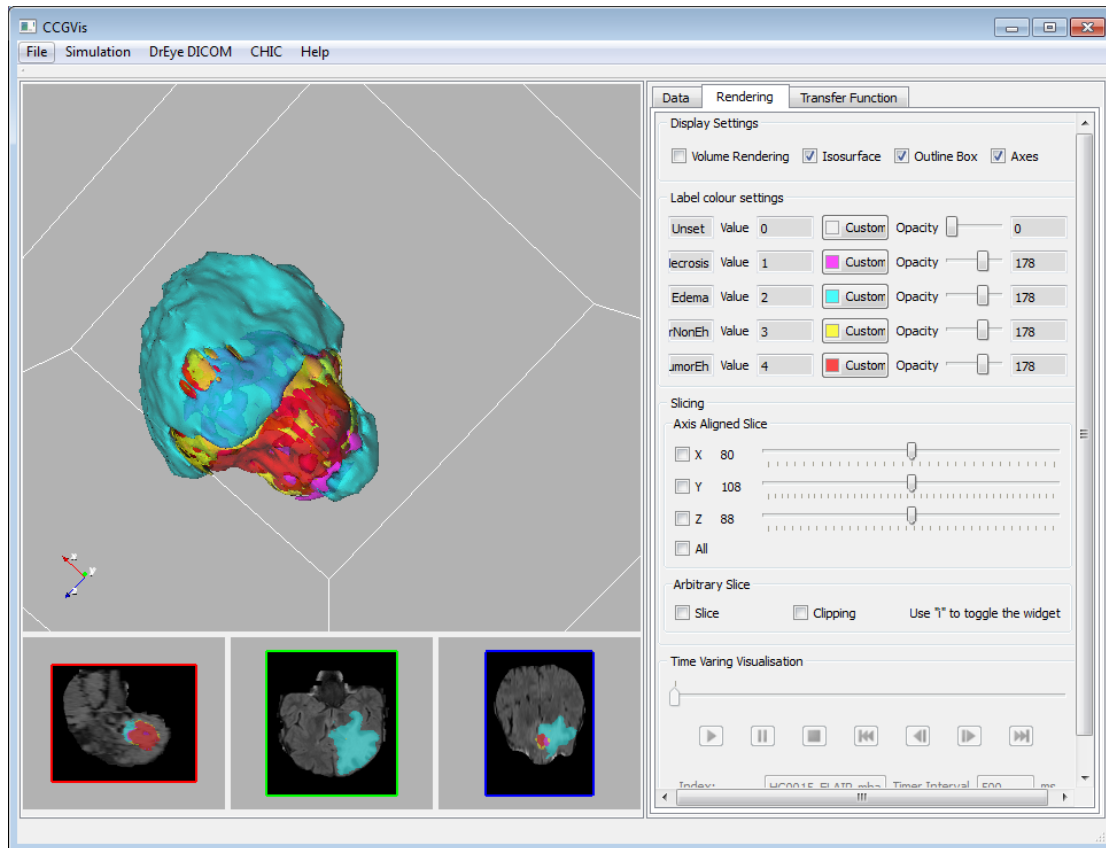


Figure 13 Isosurface rendering after data loaded

### 5.3.3 IsoSurface Rendering

As tumours are generally composed of different layers, such as necrotic, cyst, oedema, proliferate, etc, After these layers are segmented manually or semi-atomically, they can be visualised. Isosurface rendering is a common method to visualise the overall shape and composition of tumour layers.

To show/hide the isosurfaces, the user only needs to tick the Isosurface checkbox in the display setting section in the Rendering Panel as shown in Figure 13. The colour and transparency of the isosurfaces can be adjusted via the Label Colour Settings section.

An example isosurface rendering is shown in Figure 14.

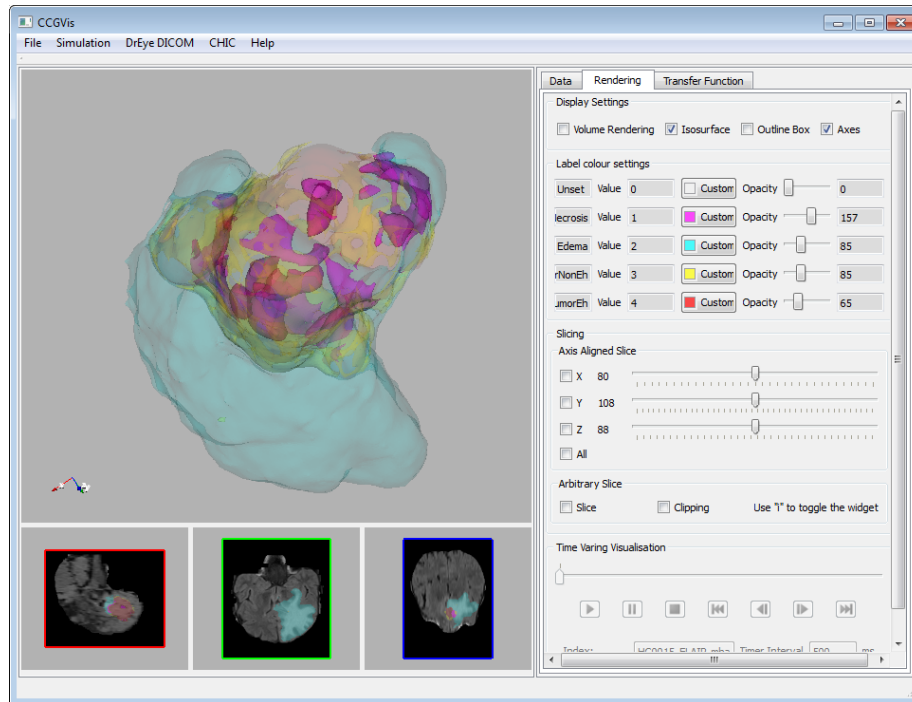


Figure 14 An Example of Isosurface Rendering

### 5.3.4 Axis Aligned Slice

Orthographic slice views are a familiar way of presenting medical image data to doctors and biomedical researchers. CCGVis provides the usual three axis-aligned slice views parallel to the coordinate planes. Axis-aligned views show sagittal, coronal and transversal images in one or multiple views. Hence, the user can view the shape of the tumour from multiple directions at the same time, thus facilitating the understanding of the tumour shape and position, as shown in Figure 15.

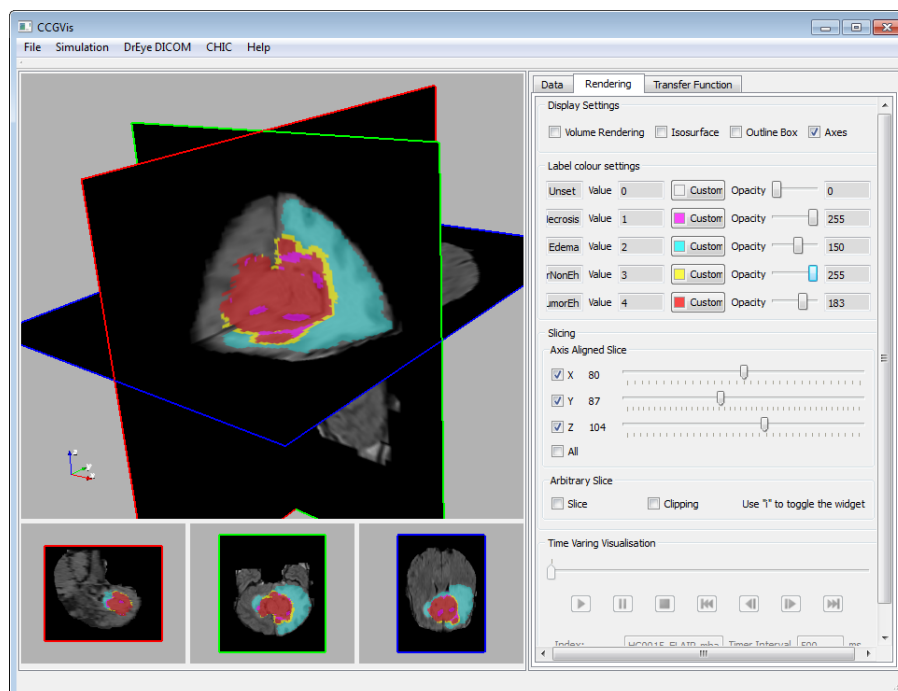


Figure 15 Axis-aligned slice view

The user can choose to show the slices by ticking the X Y Z checkbox in the Slicing section in the rendering panel, as shown in Figure 3. The user can also choose to tick the All tick-box to show all the three slice plane in one click.

There are two ways to move the slices:

- To move the slider in the Slicing section, or
- In the 3D View, first use the left mouse button to click the desired slice, then press the middle mouse button to move the slice along the axis direction.

When you move the slices, the orthogonal views at the bottom (part C in Figure 1) will also change accordingly. The slice moving is also synchronised automatically with the slice slider in the “Slicing” section.

- Caution

Currently there is a bug on slice selection, sometimes you will get the wrong slice selected. The solution is to rotate the whole scene to avoid slice overlapping on the click point.

### 5.3.5 Arbitrary Slice

Axis-aligned slices provide orthographic slice views of volume data, but the constraint on slice directions limits the freedom of interactive viewing and exploration. As the shapes of tumours are usually irregular, a cutting plane with arbitrary directions may further help the user to obtain information of the shape and interior of tumours from arbitrary angles, as shown in Figure 16.

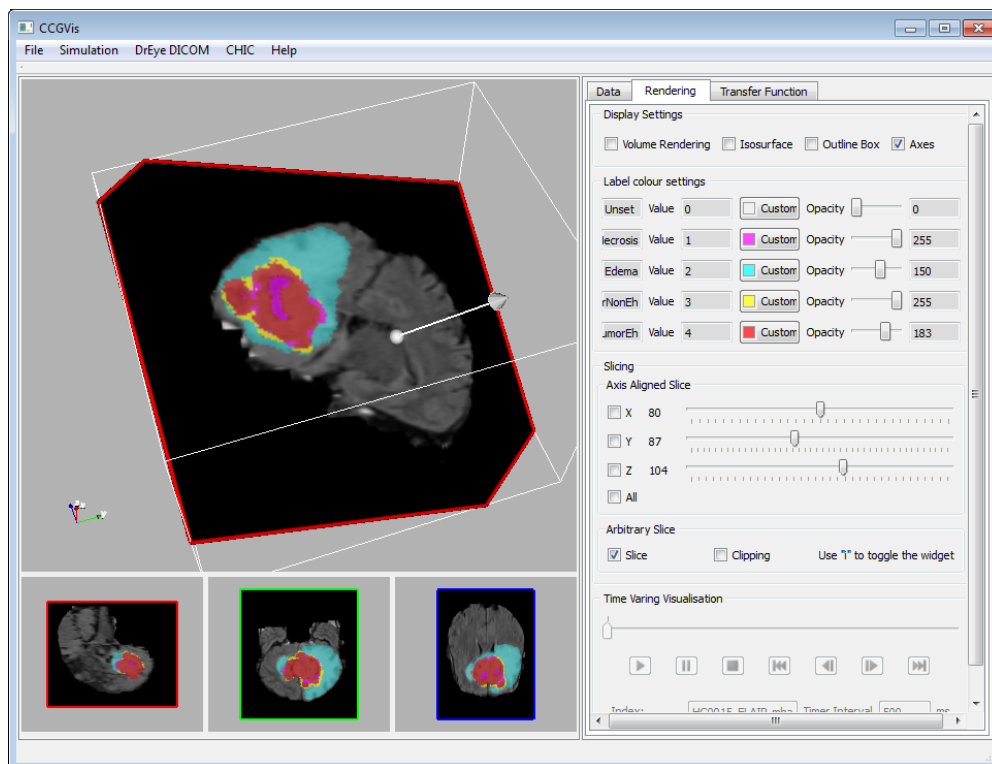


Figure 16 Arbitrary Slice Example

Tick the “Slice” checkbox in the “Arbitrary Slice” section to enable the arbitrary slice in the 3D view. The plane is shown with an arrow which points to the normal direction of the slice plane. Highlighted tumor layers are also shown on the slice.

- Use left mouse button to move the slice plane along the axis direction ( as shown by the arrow).
- Use left mouse button to click on the arrow head to select and drag the arrow to rotate the slice.
- Use left mouse button to click on the base point of the arrow on the slice and drag it to move the arrow.

Tick the “Clipping” checkbox to use the arbitrary slice as a clipping plane for volume rendering, as shown in Figure 17 and Figure 18. The volume portion above the slice ( the side where the arrowhead is) will be hidden.

#### Caution

1. The outline box of the arbitrary plane cannot be hidden
2. Clipping is only effective for volume rendering but not isosurface rendering

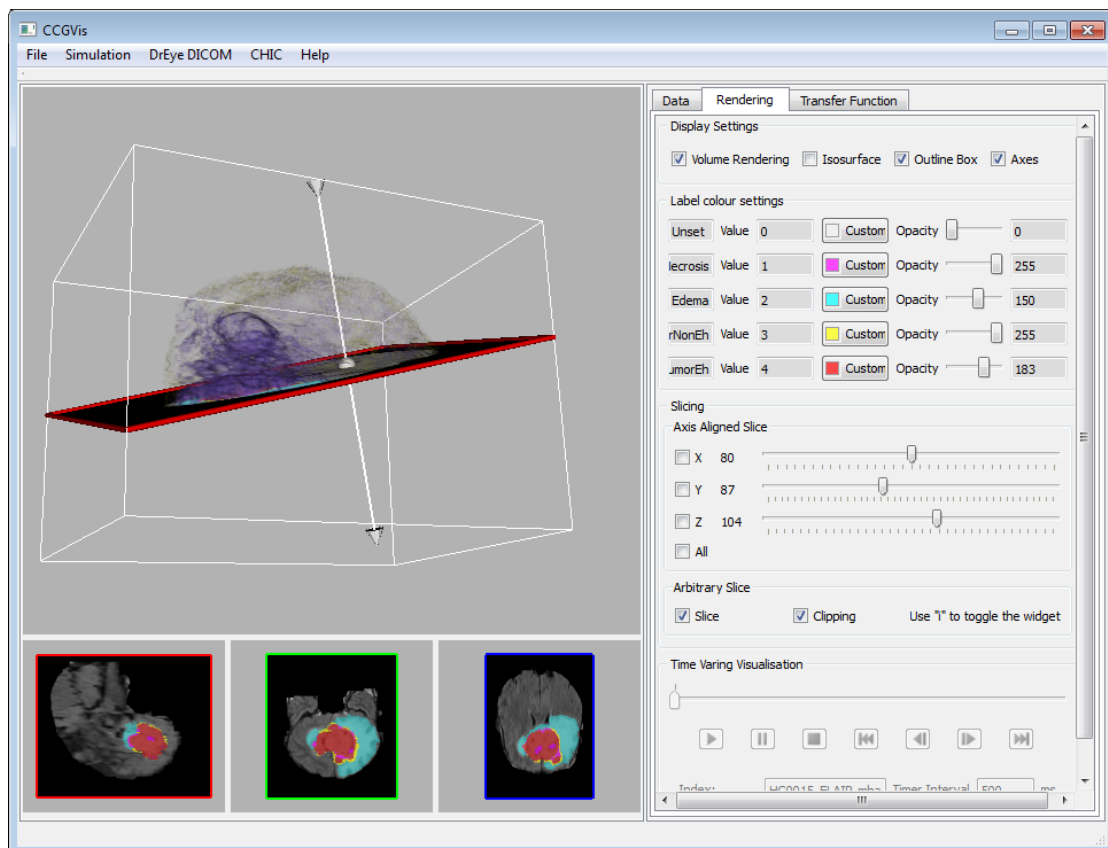


Figure 17 Use an arbitrary slice as a clipping plane for volume rendering

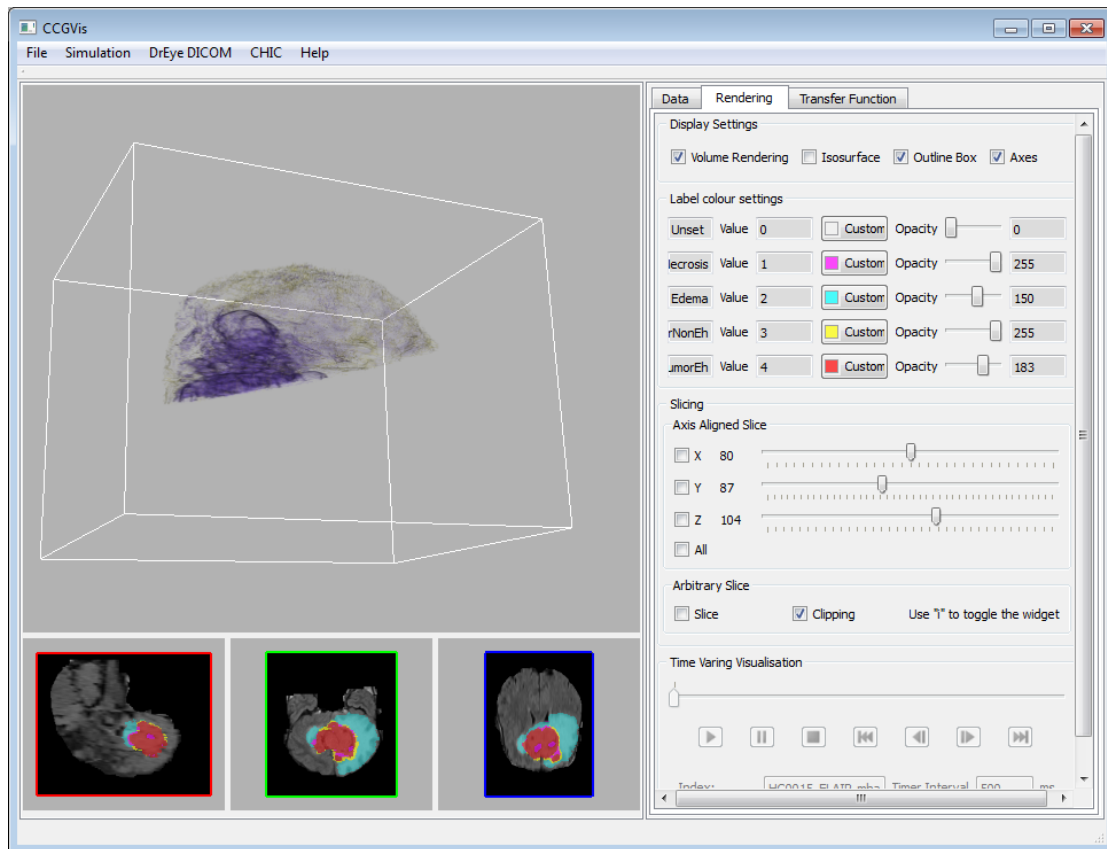


Figure 18 Clipped volume after hiding the arbitrary slice

## 5.3.6 Volume Rendering

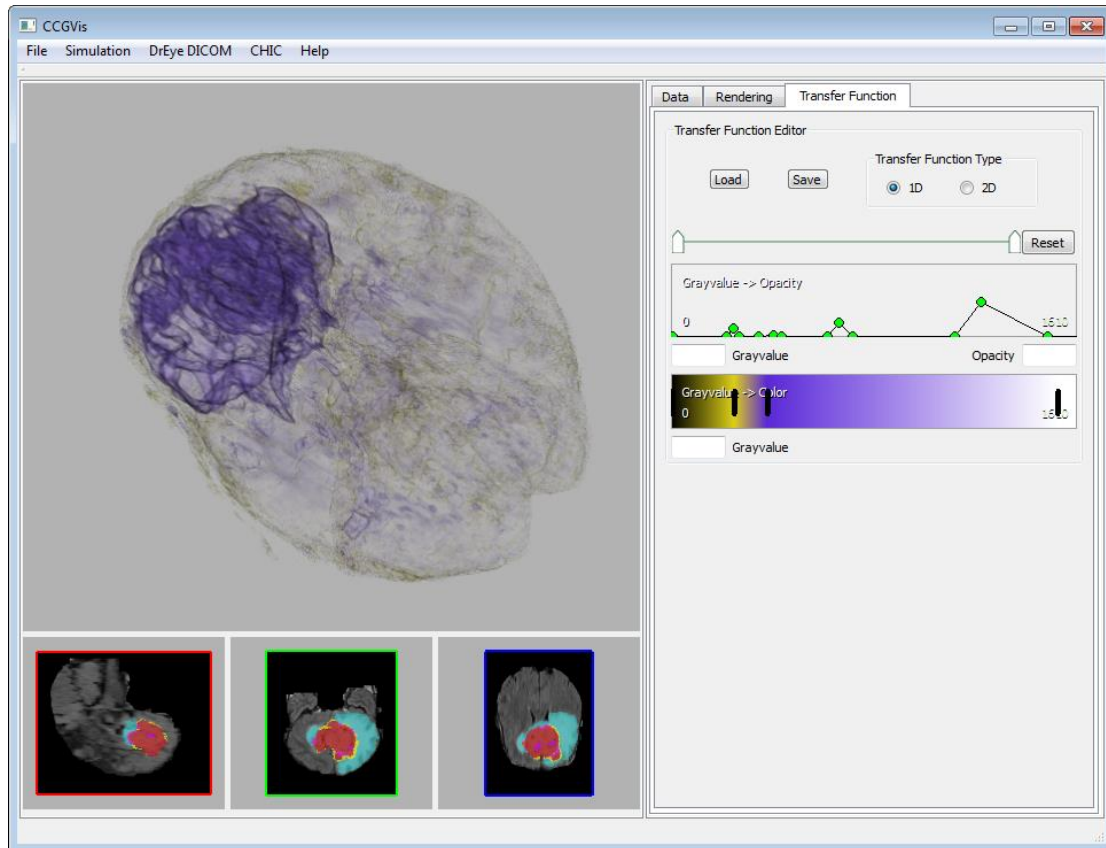


Figure 19 Volume rendering view of the brain and brain tumor

Volume rendering is helpful for visualising the contents of volume data. In CHIC, it helps researchers to understand the composition, position and shape of the tumour and the space relationship between the tumour and related tissues. Volume rendering can be enabled by ticking the “Volume Rendering” checkbox in “Display Settings” in Rendering Panel.

### 5.3.6.1 1D Transfer function Editing

Volume rendering results are highly controlled by transfer functions which can be edited in a transfer function editor. In CCGVis a 1D transfer function editor is provided for volume rendering under the Transfer Function tab, as shown in Figure 20.



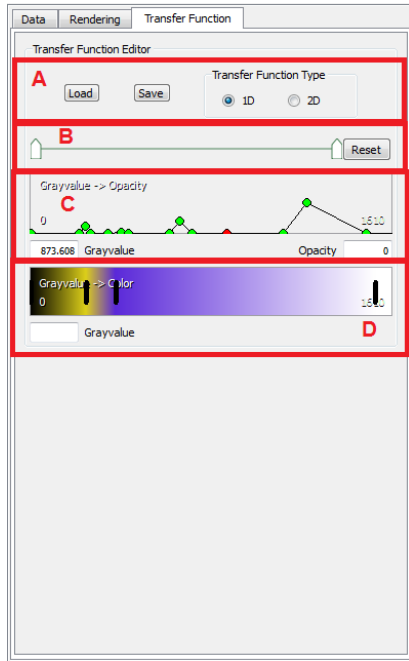


Figure 20 Transfer Function Editor

As shown in Figure 20,

- Part A is for transfer function file load or save. The user can also choose to use 1D or 2D transfer functions but in this document only 1D transfer function is introduced.
- Part B is a range slider for zooming Part C and Part D.
- Part C is a Grayvalue->Opacity editor. The horizontal axis represents the grayscale value of the volume data, the vertical axis represents the user specified opacity. The user can add new points to the piecewise line by clicking on it.
- Part D is a colour editor whose horizontal axis again represents the grayscale value of the volume data. The user can add new colour points by clicking on it. When the user double clicks the colour point, a colour editor dialogue appears for colour specification, as shown in Figure 21. If the user wants to specify an accurate grayscale value to a colour point, he can first create or select the colour point, then input the grayscale value in the bottom-left input-field and confirming by a return.

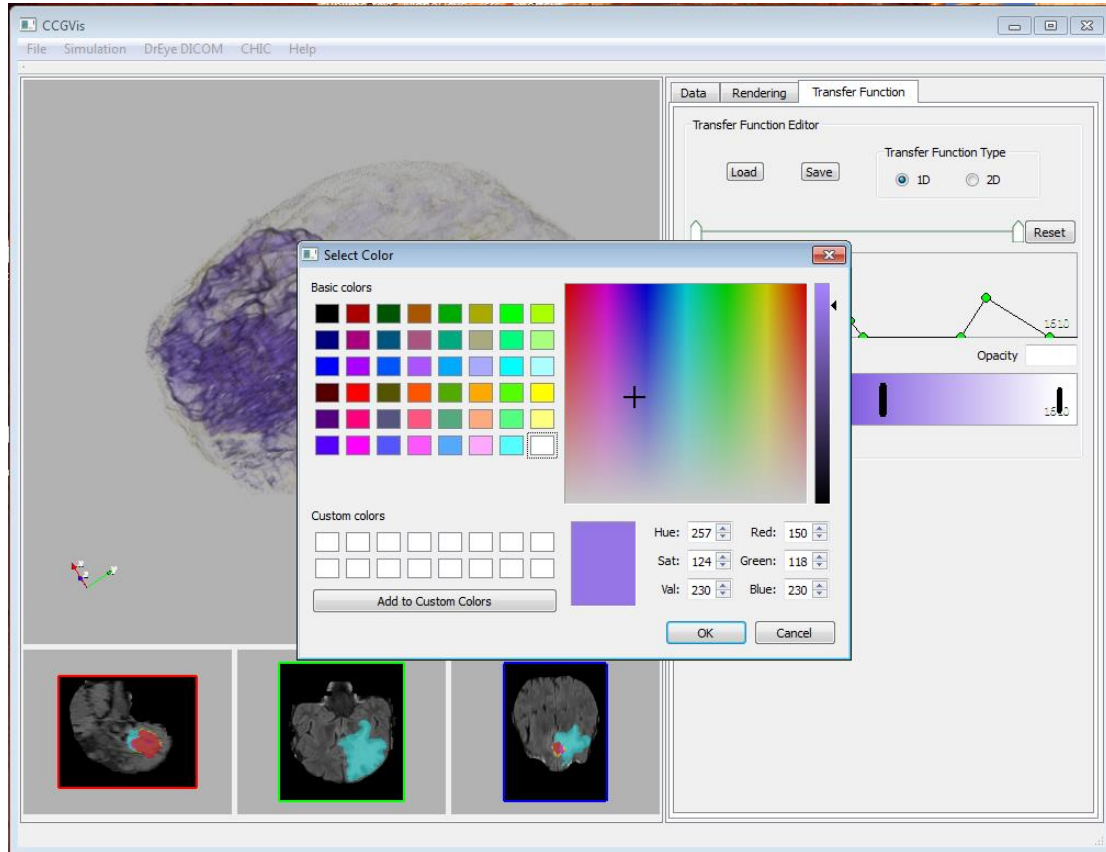


Figure 21 Colour editor for transfer function editing

## 5.4 Mixed Rendering

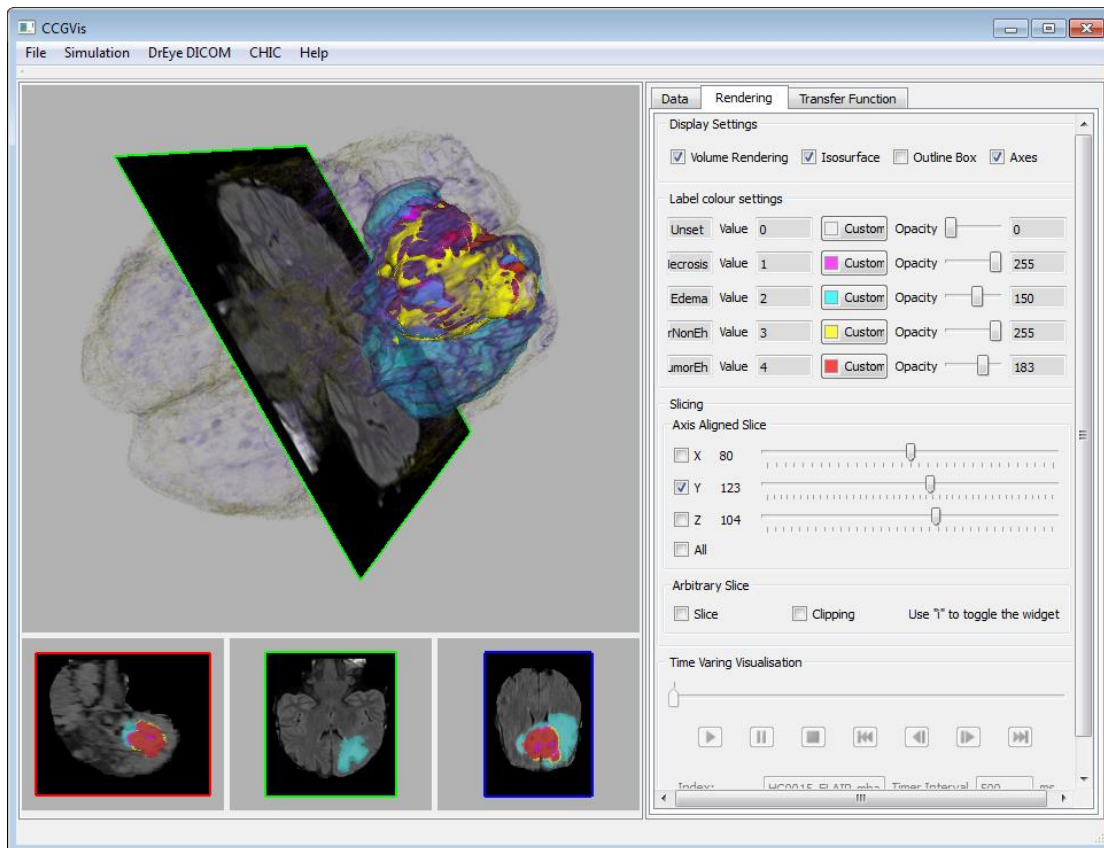


Figure 22 Mixed Rendering of Volume, Isosurfaces and Y Slice.

Mixed rendering of the isosurface and volume rendering is desirable to show layered tumours in relation to the structures of normal body tissue in 3D space. Most of the rendering modes can be used at the simultaneously. For example you can use volume rendering to show the overall shape of the brain while using isosurface to show the exact tumor location and shape. Figure 22 is an example of mixed rendering of volume, isosurfaces and a slice.

## 5.5 Time-varying visualisation

Time-varying visualisation will play time-dependent registered medical image series and simulation data along the time line using control of the “Time-varying Visualisation” section in the rendering panel ( as shown in Figure 3). It will be the future work and more detailed information is available in section 6.2.

## 5.6 Future work

### 5.6.1 Visualisation of the simulation data

Simulation can be used for tumor development prediction and tumor treatment evaluation. For visualisation of simulation data, dynamic 3D rendering of the simulated tumour volume is required and the statistics of the tumour simulation have to be plotted as 2D graphs. A special data import module will be designed for reading simulation volume data and simulation statistics.

#### **5.6.1.1 Simulation volume data visualisation**

The simulation volume data are essentially label volumes with labels representing different tumour cell types, such as normal, necrotic, proliferate, etc. Each voxel in the label volume represents a certain number of cells in the tissue and the number of cells in the simulation is usually several orders of magnitude larger than the number of voxels. With the unified visualisation core, the visualisation of the simulation volume data is very similar to that of the patient volume data. Axis-aligned slice, arbitrary slice, multi-layer isosurface rendering and multi-dimensional volume ray casting are all available for simulation volume visualisation. The difference is that the simulation volume data themselves are label volumes and the size of simulation volume data is usually much smaller.

#### **5.6.1.2 Simulation statistics visualisation**

Simulation statistics are tumour related time-dependent quantities, such as the number of cells of each type and their percentage during tumour simulation.

2D plotting of polylines or fitted curves will be used for visualising time-varying tumour simulation statistics. As the numbers of different cell types can differ greatly from each other, an option of logarithmic drawing may be used to show each curve more clearly.

### **5.6.2 Time-varying Visualisation**

The visualisation of time-dependent medical image series and simulation data requires time-varying animation of the change of tumour shape and position. Patient studies need to be sorted in time order before they are visualised sequentially.

Time-varying visualisation of medical images also demands the registration of image data at different time points as they may have different positions, dimensions or even spacing. The registration of volume data and the transformation of their corresponding label volumes will be performed by the University of Bern. The registered medical image data and label volumes will be used as inputs to CCGVis.

### **5.6.3 DrEye plugin**

DrEye is used as the main platform for medical imaging processing in CHIC. DrEye is .NET based software developed by the Foundation for Research and Technology – Hellas, Greece (FORTH) with the support of the Philips Research Centre and the University of Bern and is available freely to the scientific community. It supports semi-automatic and manual segmentation of medical images in DICOM format. In CHIC, DrEye is used for tumour segmentation and annotation – various layers of tumours are identified and annotated with different labels.

DrEye provides an architecture for customised plugins to accommodate additional imaging functionalities. Using APIs provided by DrEye, CCGVis can be implemented as a DrEye plugin under the visualisation tab (as shown in Figure 8 ) in the future.

## 6 The timeline in the clinical data repository

### 6.1 Overview

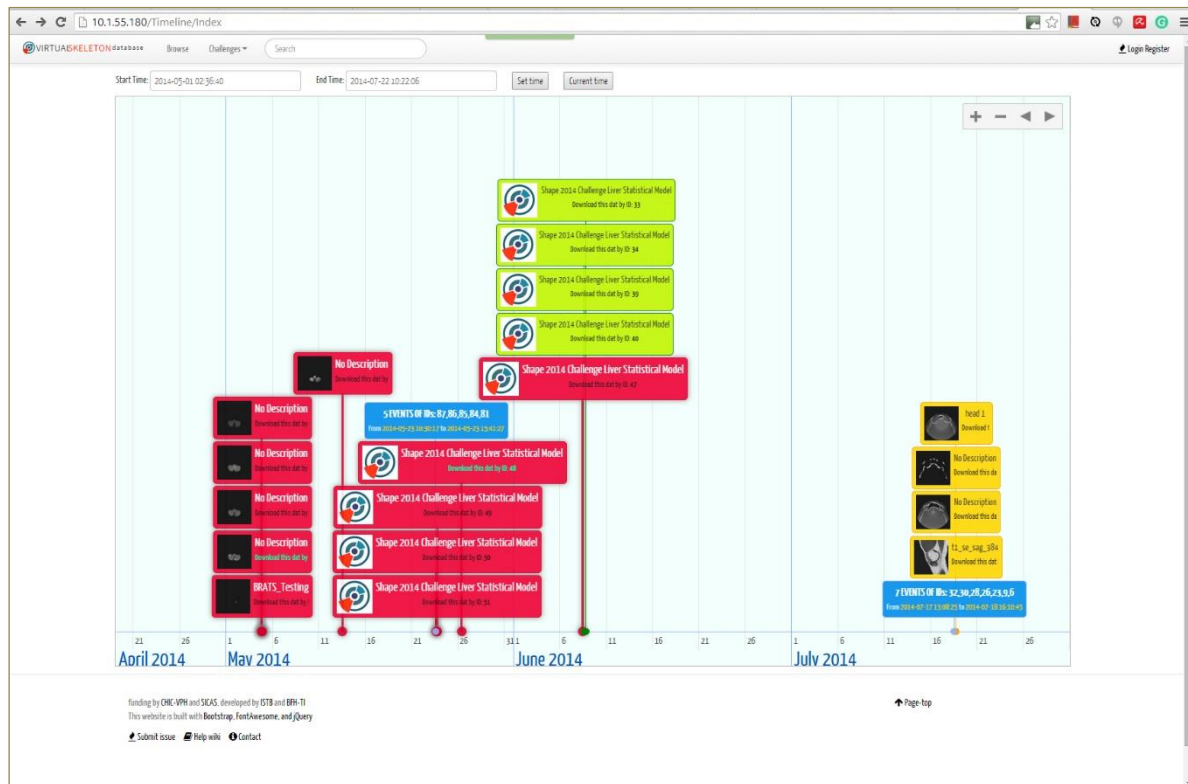


Figure 1

CHIC Timeline comes with the following feature which have been designed to make a brief overview of the available clinical data for each user:

1. Zoom-in & Zoom-out
2. Drag left and right
3. Clustering
4. Colour codes for different type of clinical data
5. Brief content of the data (Annotations or DICOM images)
6. Set time
7. Hour/day/month/year view
8. Download the favourite data directly

### 6.2 Zoom-in & Zoom-out

You can zoom in/out by scrolling the mouse wheel in order to get more precise time of the particular event on the timeline. As you can see in the figure 2, the zooming function has this capability to narrow down the timeline to detailed view (Figure 2).

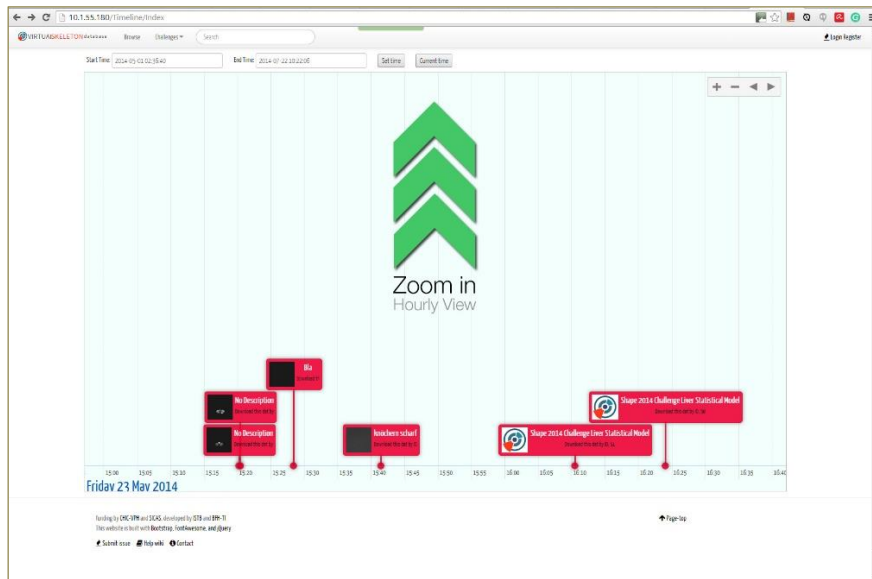


Figure 2

### 6.3 Drag Left & Right

You can drag the timeline to the left or to the right to get the ideal understanding of the events (Figure 3).

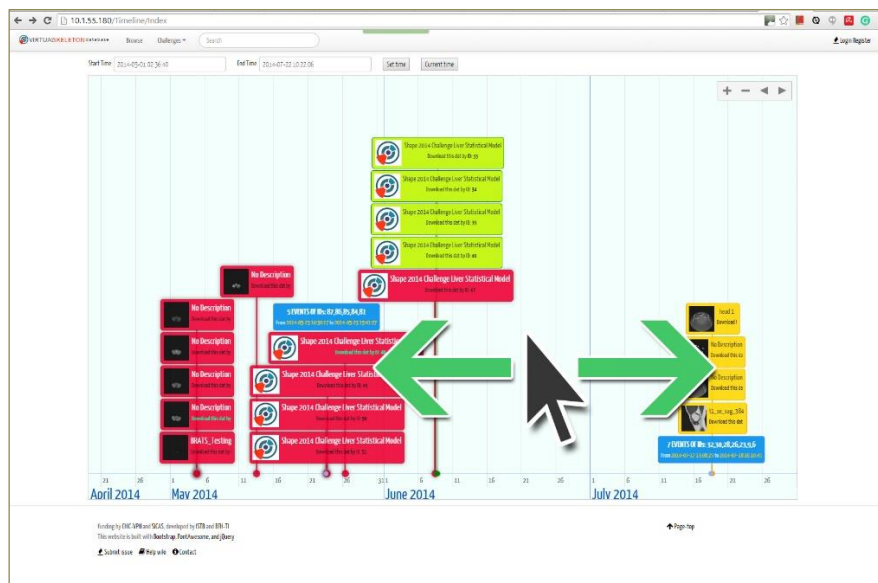


Figure 3

## 6.4 Clustering

This feature can be known as a clutter reduction in data visualisation. Fundamentally, this function can decrease the number of close by events in a different zoom level to provide a more efficient events view (Figure 4).

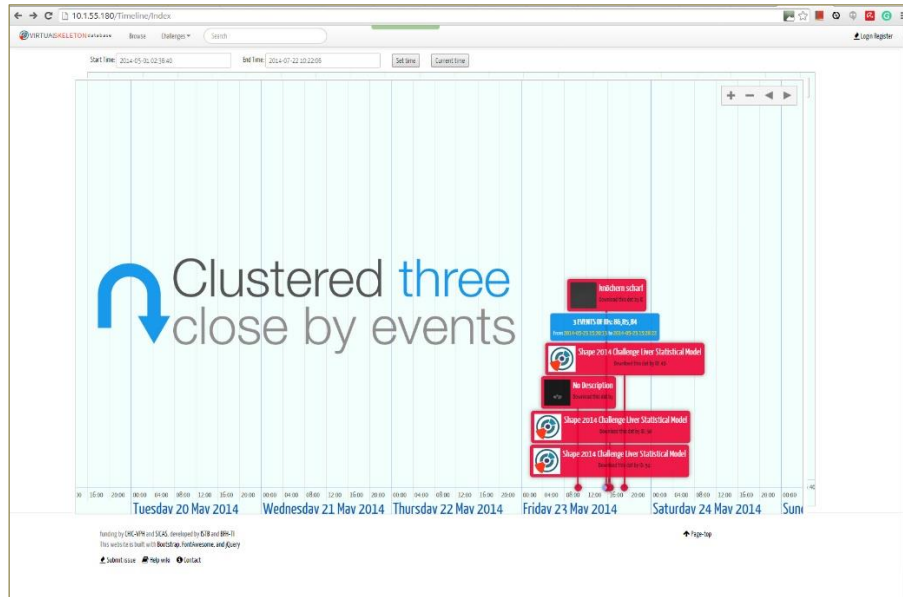


Figure 4

## 6.5 Colour codes

Different type of data can be categorised and displayed with the different colours (Figure 5).

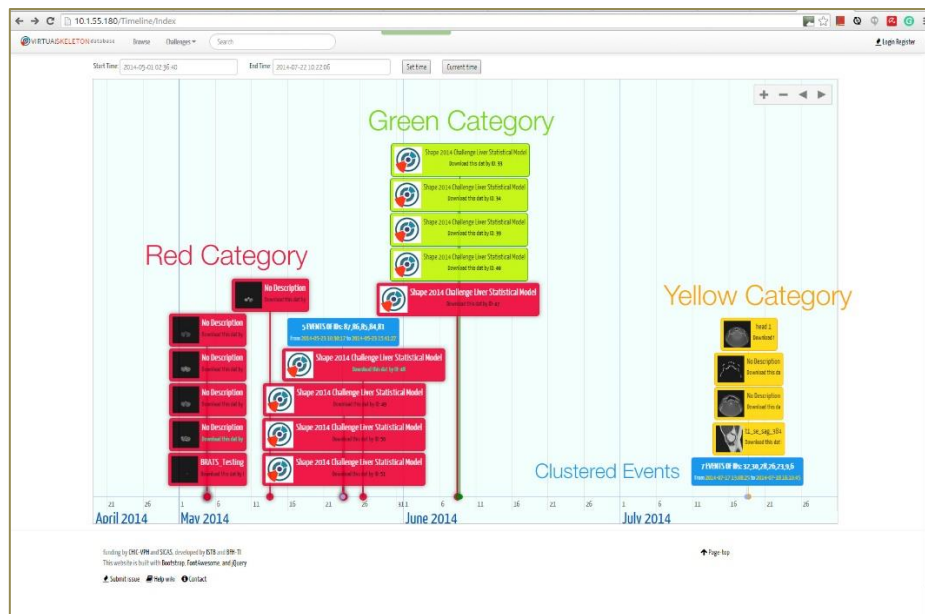


Figure 5

## 6.6 Brief Content

All the events come with the short brief description and if it is available, DICOM image (Figure 6).



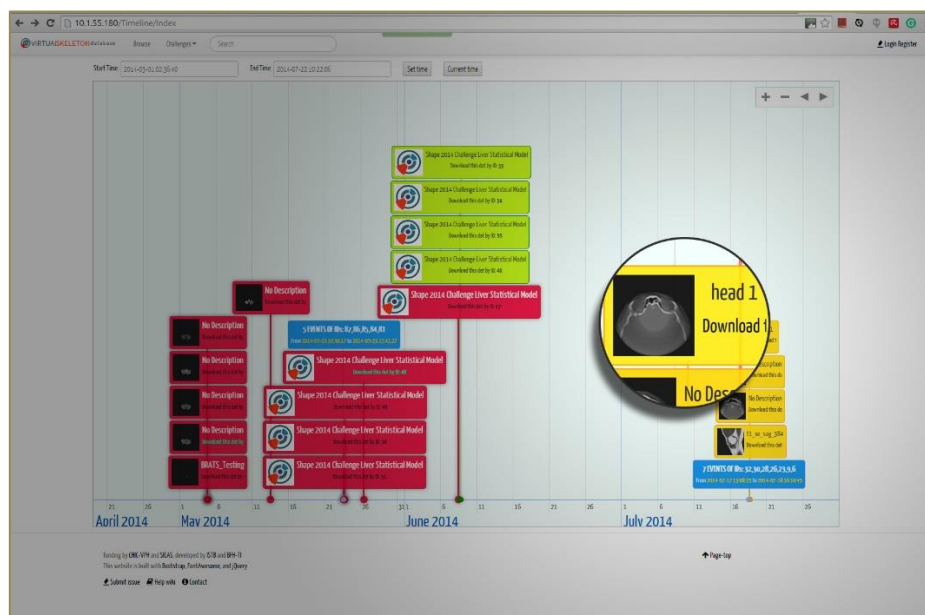


Figure 6

## 6.7 Set time

You are able to choose a specific day to start with. You can also select a start and end time to see just the existing events in that particular period (Figure 7).

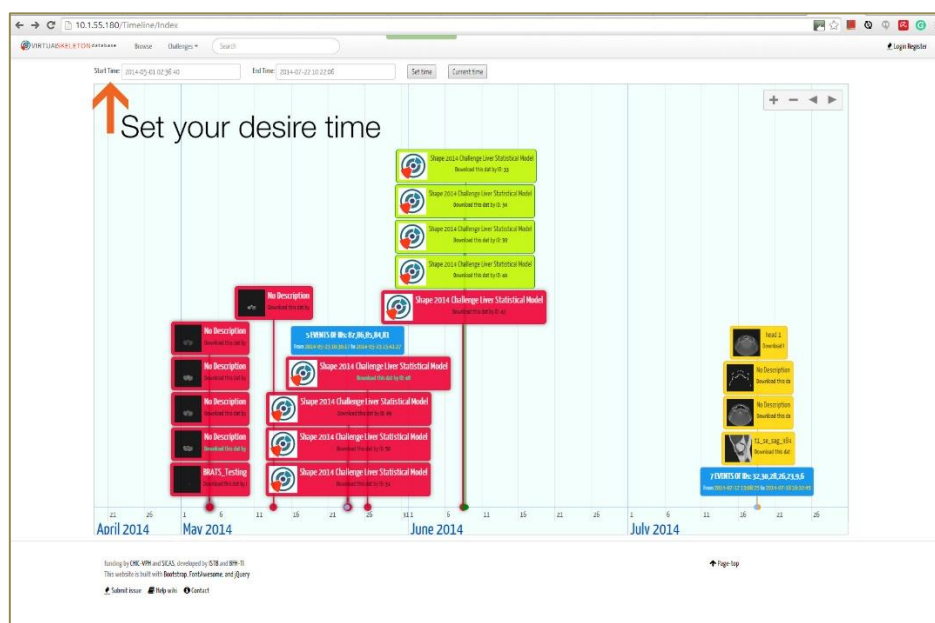


Figure 7

## 6.8 Hour/Day/Month/Year View

As it mentioned before, by zooming in/out you can change the view to yearly, monthly, daily, and hourly.

## 6.9 Download the favourite data directly

Preferred data can be downloaded directly from the timeline by clicking on the download link (Figure 8).



Figure 8

## 7 Upload tool

### 7.1 Overview

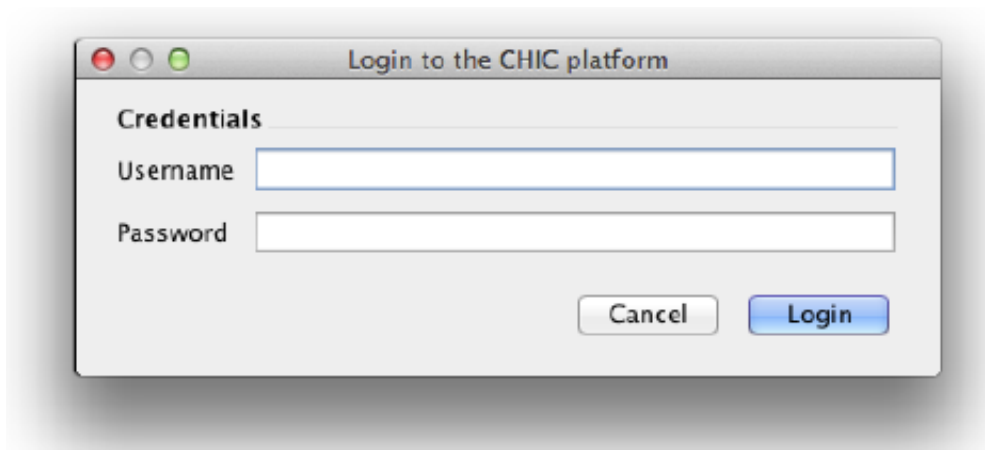
The data upload tool was developed within p-medicine and further elaborated within the CHIC project. The tool can be downloaded from here ([http://139.91.190.53/temp/chic/chic\\_upload\\_tool-0.10.zip](http://139.91.190.53/temp/chic/chic_upload_tool-0.10.zip)). It requires a Java installation and it's a single jar. After unpacking the zip file the user can "double-click" the run.bat in MS Windows or the run command in MacOS to launch the tool.

#### 7.1.1 Login Dialog

When the user launches the tool it shows a "splash" screen while loading the necessary libraries:



When fully loaded the tool requests the user to provide his/her CHIC credentials. This will make sure that the subsequent interaction with the platform is properly authenticated and authorized.



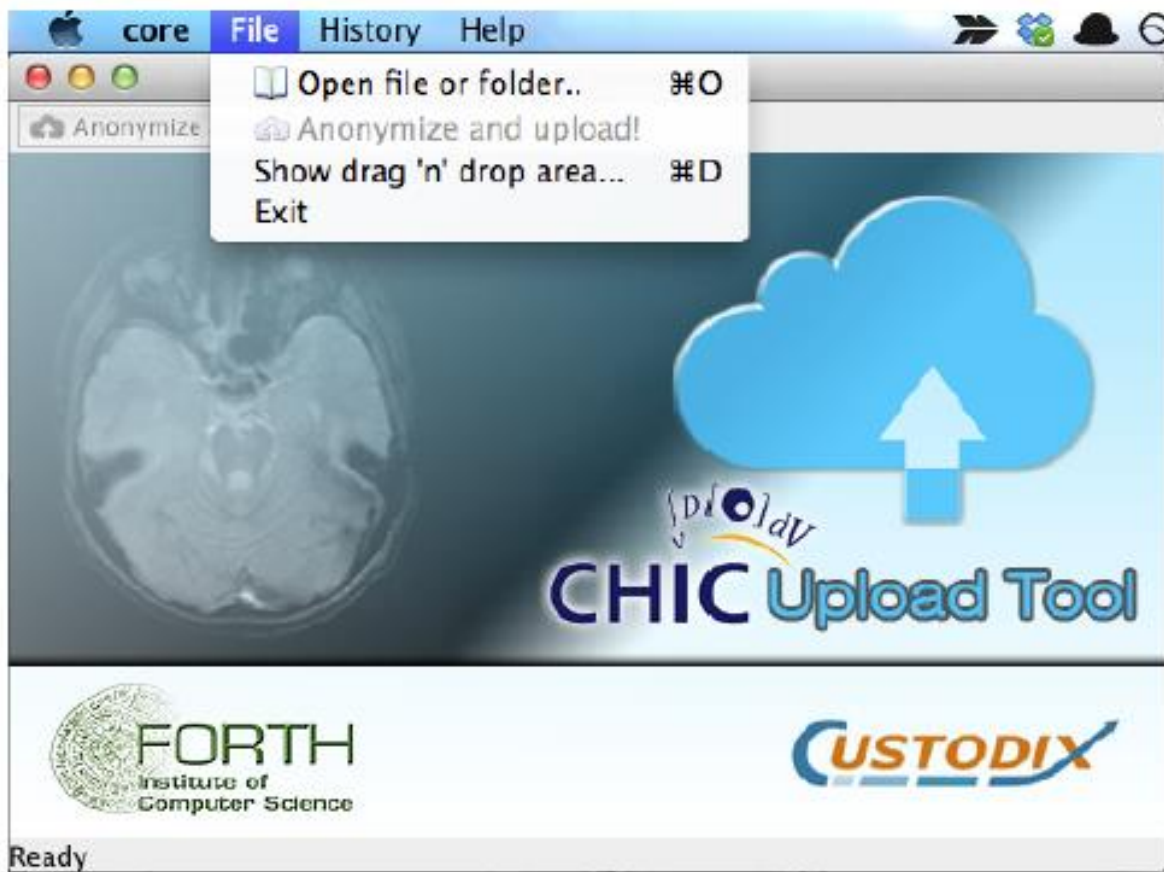
If the credentials are correct the user is then able to use the tool.

## 7.1.2 Opening a file

To open a file the user can choose 'Open file or folder' from the File menu.

## 7.1.3 Opening a file

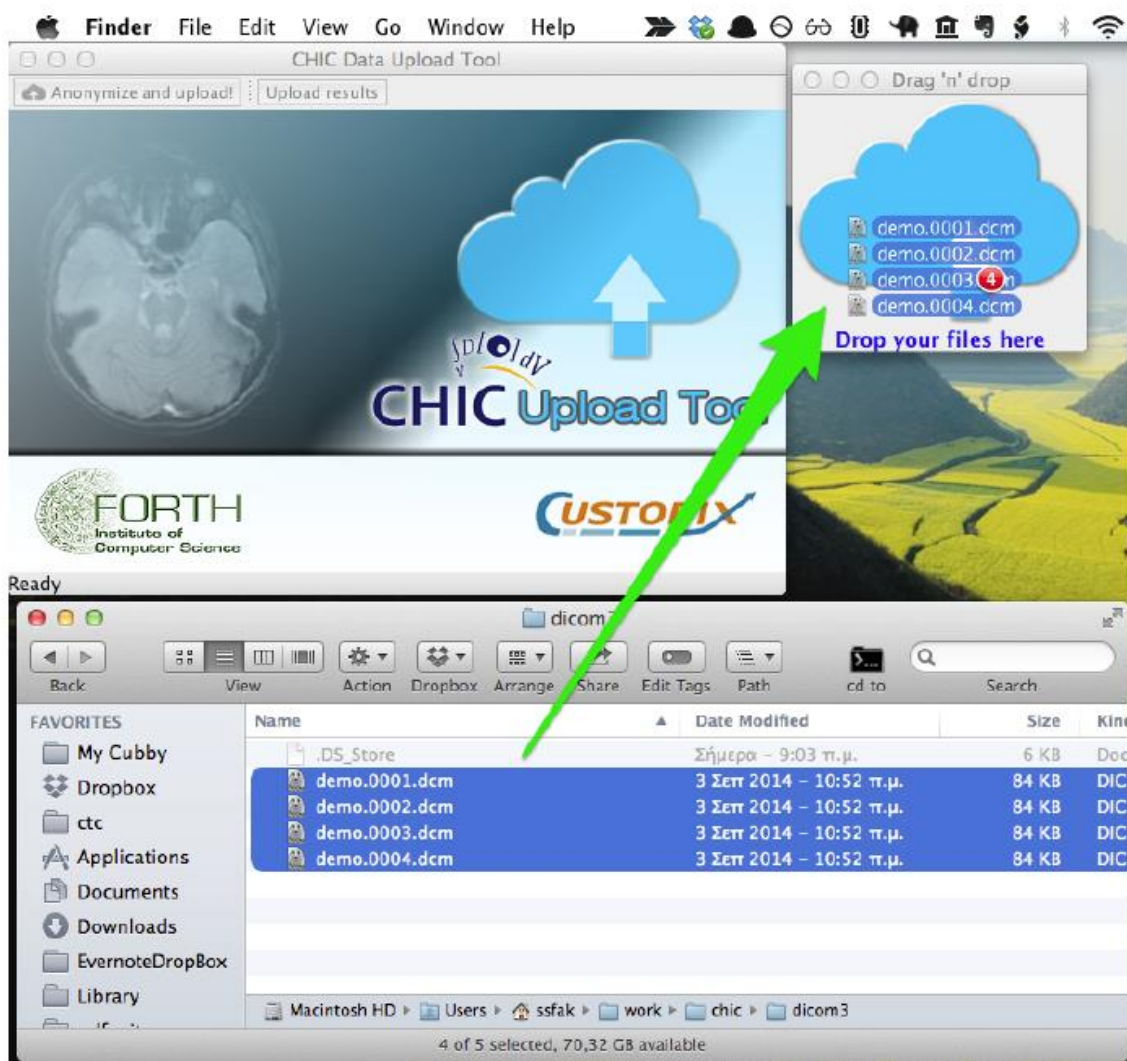
To open a file the user can choose 'Open' from the File menu.



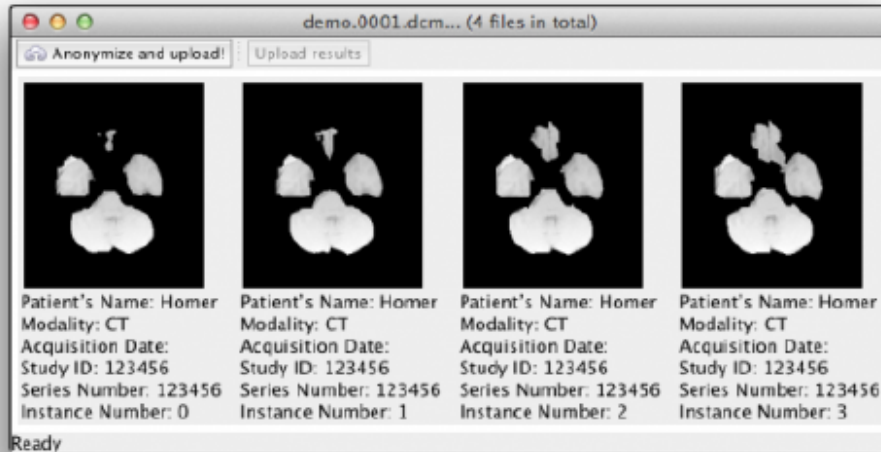
To make the selection of the file to be uploaded more easy the user can choose the "Show the drag 'n' drop area." option from the File menu (or press Control-D (in MS Windows) or Cmd-D (in Mac OS)). A new window then appears where the user can "drag and drop" the file.



To make the selection of the file to be uploaded more easy the user can choose the "Show the drag 'n' drop area" option from the File menu (or press Control-D (in MS Windows) or Cmd-D (in Mac OS)). A new window then appears where the user can "drag and drop" the file. An example is given below.

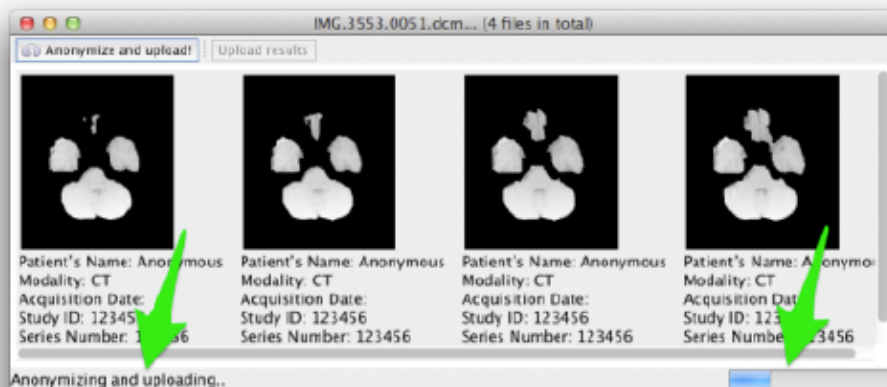


After the files are loaded the user can have a "preview" of them, as shown in the next figure for the case of multiple DICOM file. The Upload Tool shows some basic information (such as the patient's name) for each image:



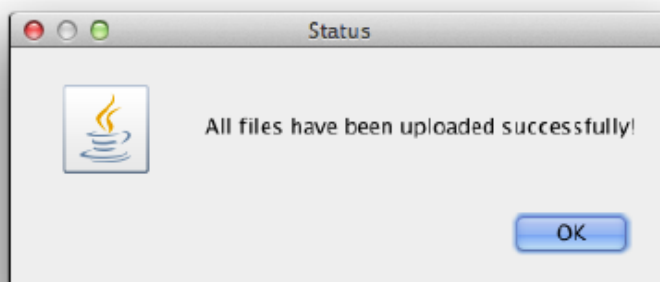
#### 7.1.4 Anonymization and uploading

When the user chooses the "Anonymize and upload" menu option (or presses the corresponding button) all of the images will be processed (pseudonymized) and then uploaded to the CHIC platform. In case that there are many images the progress bar in the bottom left area of the window can be handy, as shown in the next figure:



After the files have been correctly pseudonymized and uploaded, the user gets a Success message:





### 7.1.5 History

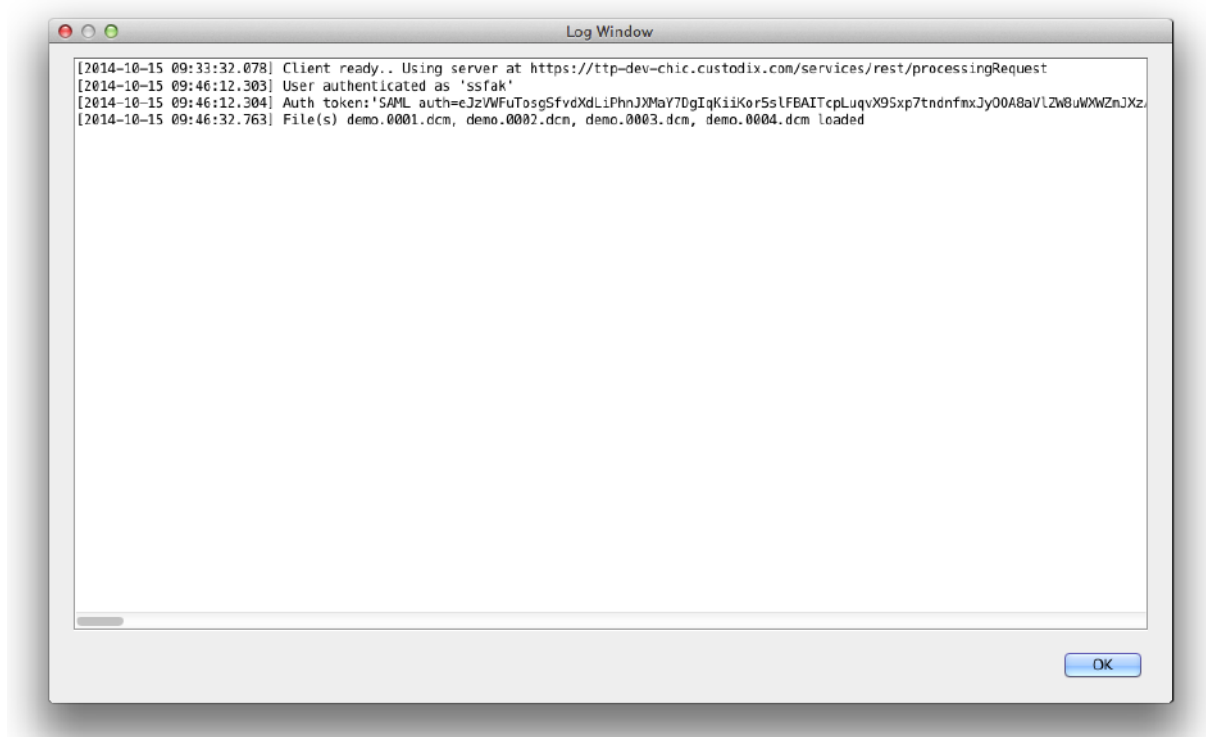
The user can also see the history of his/her past uploads by selecting the "Recent uploads" menu item from the History menu

A screenshot of a macOS-style dialog box titled "Recent uploads". It contains a table with four columns: Date, File, Database ID, and Upload ID. The table lists various upload records, with the last row highlighted in blue.

Date	File	Database ID	Upload ID
2014-09-02 09:59:22.859	/Users/ssfak/work/chic/uploadtool/a.dcm	n57cx4fi4jwpg24nsb4g2gbz5pjmtths.dcm	4380438
2014-09-02 10:14:39.086	/Users/ssfak/work/chic/uploadtool/a.dcm	n57cx4fi4jwpg24nsb4g2gbz5pjmtths.dcm	4380439
2014-09-02 10:22:53.116	/Users/ssfak/work/chic/uploadtool/a.dcm	n57cx4fi4jwpg24nsb4g2gbz5pjmtths.dcm	4380440
2014-09-02 16:06:44.869	/Users/ssfak/work/chic/dicom/IMG.3553.0051.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0051.dcm	4600469
2014-09-02 16:06:46.927	/Users/ssfak/work/chic/dicom/IMG.3553.0052.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0052.dcm	4600470
2014-09-02 16:06:49.495	/Users/ssfak/work/chic/dicom/IMG.3553.0053.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0053.dcm	4600471
2014-09-02 16:06:51.228	/Users/ssfak/work/chic/dicom/IMG.3553.0054.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0054.dcm	4600472
2014-09-03 08:57:21.976	/Users/ssfak/work/chic/dicom2/IMG.3553.0051.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0051.dcm	4660470
2014-09-03 08:57:23.189	/Users/ssfak/work/chic/dicom2/IMG.3553.0052.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0052.dcm	4660471
2014-09-03 08:57:24.333	/Users/ssfak/work/chic/dicom2/IMG.3553.0053.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0053.dcm	4660472
2014-09-03 08:57:25.492	/Users/ssfak/work/chic/dicom2/IMG.3553.0054.dcm	lyuklj5ycnpobiva6erpdruurb7sje6j.0054.dcm	4660473
2014-09-03 11:25:25.104	/Users/ssfak/work/chic/dicom3/demo.0001.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0001.dcm	4730481
2014-09-03 11:25:26.409	/Users/ssfak/work/chic/dicom3/demo.0002.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0002.dcm	4730482
2014-09-03 11:25:27.688	/Users/ssfak/work/chic/dicom3/demo.0003.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0003.dcm	4730483
2014-09-03 11:25:28.936	/Users/ssfak/work/chic/dicom3/demo.0004.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0004.dcm	4730484
2014-09-03 14:46:22.582	/Users/ssfak/work/chic/dicom3/demo.0001.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0001.dcm	4730485
2014-09-03 14:46:25.316	/Users/ssfak/work/chic/dicom3/demo.0002.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0002.dcm	4730486
2014-09-03 14:46:28.612	/Users/ssfak/work/chic/dicom3/demo.0003.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0003.dcm	4730487
2014-09-03 14:46:31.423	/Users/ssfak/work/chic/dicom3/demo.0004.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0004.dcm	4730488
2014-10-15 09:13:34.539	/Users/ssfak/work/chic/dicom3/demo.0001.dcm	nrsth5i3yngzqp3nmmlqrliz47bi667.0001.dcm	4790480

### 7.1.6 Log window

From the Help menu the user has access to the Log window (from the Help menu) that contains some informational (debug) messages.



### 7.1.7 References

Retrieved from "[http://chic-wiki.isog.iccs.ntua.gr/index.php?title=Data\\_Upload\\_Tool&oldid=339](http://chic-wiki.isog.iccs.ntua.gr/index.php?title=Data_Upload_Tool&oldid=339)", last modified on 15 October 2014, at 10:12.



## 8 Results of the Evaluation

### 8.1 Overview

From the 15<sup>th</sup> of October to the 20<sup>th</sup> of November altogether 48 evaluations were done by endusers. The following table shows the number of evaluations per tool.

	DrEye	BraTumIA	CCGVis	Timeline and clinical data repository	Upload Tool
Number	12	10	8	12	6

All of the endusers are members of the CHIC consortium, and most of them are clinicians, so that the first evaluation round was an internal one. The main objective was to check usability of the 5 different tools. Sustainability and maintenance was evaluated as well, despite the fact that most of the efforts for sustainability and maintenance will be done during the upcoming time periods of the CHIC project.

According to the criteria for evaluation defined in D11.1 all items were classified as being available yes or no, or unknown. For few items availability was further classified into: not at all, minimal, partly, mainly or completely, if such a grading made sense. Only answers to items given availability yes, mainly or completely are regarded as good usability or sustainability & maintenance. Only these answers are further analysed and mean values of all evaluators were calculated for each of them. All other answers are regarded as insufficient usability or sustainability & maintenance. As more than 1 item characterizes different categories of usability, sustainability & maintenance, mean values for each category were calculated to summarize the results of each category over all evaluators. For example: One of the categories of usability is understandability including the following items:

- Understandability of what the software does and its purpose
- Understanding of the intended market and users of the software
- Understanding the basic functions of the software
- Understanding the advanced functions of the software
- Availability of a high-level description of the software
- Availability of a high-level description of the software of what it does
- Availability of a high-level description of the software of how it works
- Availability of the design rationale
- Availability of the architectural overview
- Availability of intended use cases
- Availability of case studies

For each item the percentage of users answering with yes, mainly or completely was primarily calculated and in addition the mean percentage of all these items for each of the categories was

calculated as well. These percentages are given for the different tools in the following chapters. To get an immediate overview of the evaluation percentages categories between 100 and 80% are regarded as sufficient and coloured in green, between 60 and 80% are coloured in yellow, between 40 and 60% are coloured in orange and below 40% are coloured in red. These colours are used in figures of chapter 9. All percentages below 80% are classified as insufficient needing optimization of the tool regarding the corresponding category.

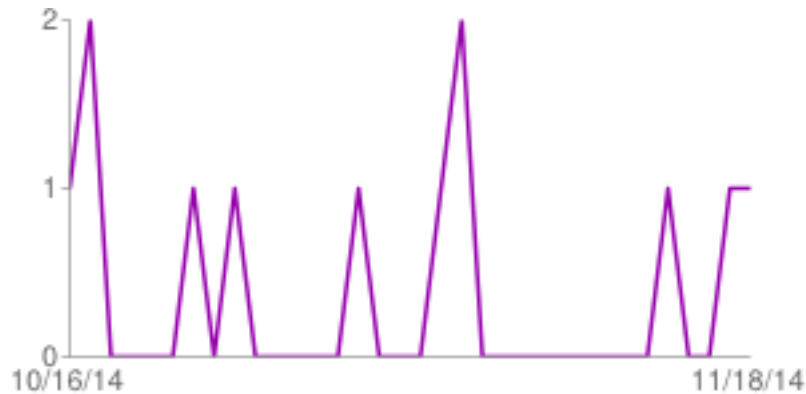
Results of the evaluation are used for improving the tools. This is done in close collaboration with all stakeholders of the project. Via a feedback loop between endusers and the developers usability and sustainability & maintenance will improve according to the results of this evaluation round.

In the following chapters the results of the evaluation of each of the tools is described in summary. Detailed information is available online, giving the results of each of the items of the evaluation process. The link to the online results of each tool is given in the following chapters.

As the virtual machines are kept online the evaluation process can be carried on. After updating of the tools according to the evaluation process new evaluations can take place and improvements can be demonstrated.

## 8.2 Evaluation of DrEye

DrEye was evaluated by 12 endusers from the CHIC consortium. The evaluation did take place since the consortium meeting in Leuven in October 2014. The number of daily evaluations is given in the following figure:



### 8.2.1 Results of Usability

According to the criteria for usability as finalized in D11.1 four major aspects of usability were analysed:

- Understandability
- Documentation
- Buildability
- Learnability

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	DrEye
<b>Understandability</b>	
How straightforward is it to understand:	100
• What the software does and its purpose?	
• The intended market and users of the software?	84
• The software's basic functions?	83
• The software's advanced functions?	42
High-level description of what/who the software is for is available.	67
High-level description of what the software does is available.	75
High-level description of how the software works is available.	67
Design rationale is available – why it does it the way it does.	42

Architectural overview, with diagrams, is available.	25
Descriptions of intended use cases are available.	42
Case studies of use are available.	42
<b>Summary</b>	<b>60,8</b>

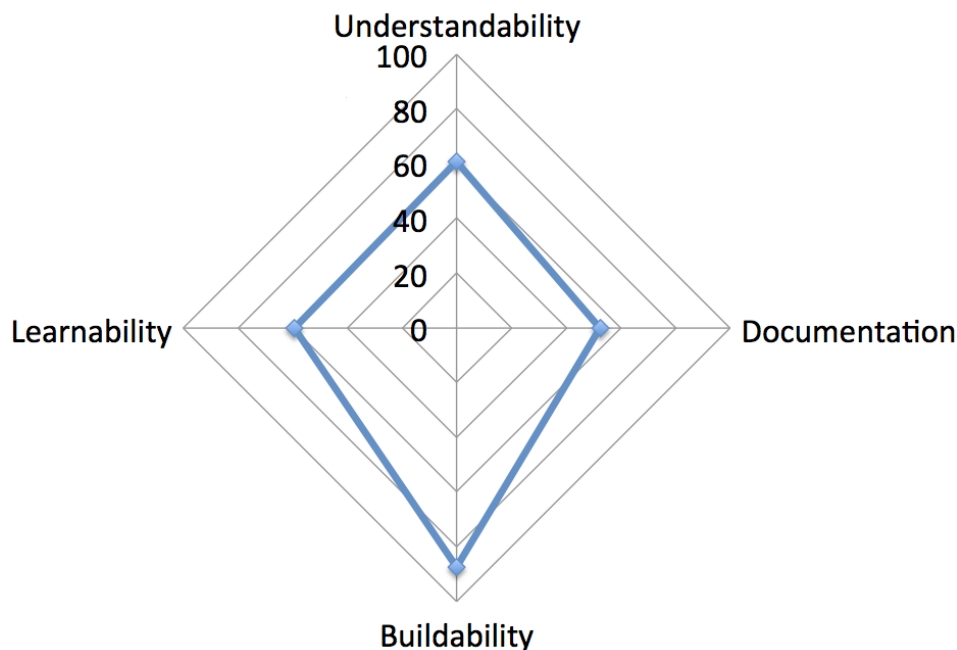
	DrEye
<b>Documentation</b>	
Looking at the user documentation, what is its	100
<ul style="list-style-type: none"> <li>Quality?</li> </ul>	100
<ul style="list-style-type: none"> <li>Completeness?</li> </ul>	100
<ul style="list-style-type: none"> <li>Accuracy?</li> </ul>	100
<ul style="list-style-type: none"> <li>Appropriateness?</li> </ul>	100
<ul style="list-style-type: none"> <li>Clarity?</li> </ul>	100
Provides a high-level overview of the software.	75
Partitioned into sections for users, user-developers and developers (depending on the software).	33
States assumed background and expertise of the reader, for each class of user.	25
Lists resources for further information.	33
Further information is suitable for the level of the reader, for each class of user.	25
Is task-oriented.	50
Consists of clear, step-by-step instructions.	83
Gives examples of what the user can see at each step e.g. screen shots or command-line excerpts.	75
For problems and error messages, the symptoms and step-by-step solutions are provided.	17
Does not use terms like “intuitive”, “user friendly”, “easy to use”, “simple” or “obviously”, unless as part of quotes from satisfied users	42
States command names and syntax, says what menus to use, lists parameters and error messages exactly as they appear or should be typed.	58
Uses teletype-style fonts for command-line inputs and outputs, source code fragments, function names, class names etc.	25
For Java, the package names of classes are stated the first time a class is mentioned.	8
English language descriptions of commands or errors are provided but only to complement the above.	33
Plain-text files (e.g. READMEs) use indentation and underlining (e.g. === and ---) to structure the text.	25
Plain-text files (e.g. READMEs) do not use TAB characters to indent the text.	33
API documentation e.g. JavaDoc or Doxygen, documents APIs completely e.g. configuration files, property names etc.	17

Is held under version control alongside the code.	25
Is on the project web site.	67
Documentation on the project web site makes it clear what version of the software the documentation applies to.	58
<b>Summary</b>	<b>52,28</b>

	<b>DrEye</b>
<b>Buildability</b>	
Was the tool stable running	83
Was the tool fast responding	92
<b>Summary</b>	<b>87,5</b>

	<b>DrEye</b>
<b>Learnability</b>	
How straightforward is it to learn how to achieve:	
• Basic functional tasks?	100
• Advanced functional tasks?	75
A getting started guide is provided outlining a basic example of using the software.	67
Instructions are provided for many basic use cases.	58
Instructions are provided supporting all use cases.	42
Reference guides are provided for all command-line, GUI and configuration options.	33
API documentation is provided for user-developers and developers.	42
<b>Summary</b>	<b>59,6</b>

In summary the usability of DrEye is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



In addition the following comments were given:

**Understandability:**

Still need improvement the automatic edge detection tool

Clicking on logo to start is not obvious. Clicking space bar to execute the snake is something you'd never guess in a million years.

**Documentation:**

Two different files are provided in project's site. One for the users and one for the plugin developers. Documentation not found

**Buildability:**

Only the 3D Visualization functionality was a little bit unstable

**Learnability:**

No comments are given.

**General comments regarding usability:**

For someone not using windows 7 it can be difficult to find the basic command like open a file. But in other hand the usability is pretty good.

In general the tool is easy to use and learn. You can fastly understand what you can do and in what way. The tool gives adequate information about the progress of every procedure.

Good

Good

Usability is good in general

## 8.2.1 Results of sustainability and Maintenance

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	DrEye
<b>Identity</b>	
To what extent is the identity of the project/software clear and unique both within its application domain and generally?	42
Project/software has its own domain name.	67
Project/software has a logo.	58
Project/software has a distinct name within its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	50
Project/software has a distinct name regardless of its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	25
Project/software name does not throw up embarrassing “did you mean...” hits on Google.	0
Project/software name does not violate an existing trade-mark.	0
<b>Summary</b>	<b>34,6</b>

	DrEye
<b>Copyright</b>	
To what extent is it clear who wrote the software and owns its copyright?	92
Web site states copyright.	58
Web site states who developed/develops the software, funders etc.	83
If there are multiple web sites then these all state exactly the same copyright, licencing and authorship.	8
Each source code file has a copyright statement.	8
If supported by the language, each source code file has a copyright statement embedded within a constant.	0
Each source code file has a licence header.	0
<b>Summary</b>	<b>35,6</b>

	DrEye
<b>Licencing</b>	
Has an appropriate licence been adopted?	50
Web site states licence.	58
Software (source and binaries) has a licence.	17
Software has an open source licence.	8
Software has an Open Software Initiative <sup>5</sup> (OSI)-recognised licence.	8
<b>Summary</b>	<b>28,2</b>

	DrEye
<b>Governance</b>	
To what extent does the project make its management, or how its software development is managed, transparent?	50
Project has defined a governance policy.	33
Governance policy is publicly available.	17
<b>Summary</b>	<b>33,3</b>

	DrEye
<b>Community</b>	
To what extent does/will an active user community exist for this product?	50
Web site has statement of number of users/developers/members.	25
Web site has success stories.	0
Web site has quotes from satisfied users.	0
Web site has list of important partners or collaborators.	42
Web site has list of the project's publications.	17
Web site has list of third-party publications that cite the software.	8
Web site has list of software that uses/bundles this software.	17

<sup>5</sup> <http://www.opensource.org/>



Users are requested to cite the project if publishing papers based on results derived from the software.	8
Users are required to cite a boilerplate citation if publishing papers based on results derived from the software.	17
Users exist who are not members of the project.	33
Developers exist who are not members of the project.	17
<b>Summary</b>	<b>19,5</b>

	<b>DrEye</b>
<b>Accessibility</b>	
To what extent is the software accessible?	75
Binary distributions are available (whether for free, payment, registration).	92
Binary distributions are freely available.	100
Binary distributions are available without the need for any registration or authorisation of access by the project.	83
Source distributions are available (whether for free, payment, registration).	42
Source distributions are freely available.	33
Source distributions are available without the need for any registration or authorisation of access by the project.	33
Access to source code repository is available (whether for free, payment, registration).	17
Anonymous read-only access to source code repository.	17
Ability to browse source code repository online.	17
Repository is hosted externally to a single organisation/ institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of any current funding line.	25
Downloads page shows evidence of regular releases (e.g. six monthly, bi-weekly, etc.).	8
<b>Summary</b>	<b>45,2</b>

	<b>DrEye</b>
<b>Testability</b>	
How straightforward is it to test the software to verify modifications?	50
Project has unit tests.	17
Project has integration tests.	17
For GUIs, project uses automated GUI test frameworks.	8

Project has scripts for testing scenarios that have not been automated (e.g. for testing GUIs).	8
Project recommends tools to check conformance to coding standards.	8
Project has automated tests to check conformance to coding standards.	8
Project recommends tools to check test coverage.	8
Project has automated tests to check test coverage.	8
A minimum test coverage level that must be met has been defined.	8
There is an automated test for this minimum test coverage level.	8
Tests are automatically run nightly.	8
Continuous integration is supported – tests are automatically run whenever the source code changes.	17
Test results are visible to all developers/members.	8
Test results are visible publicly.	8
Test results are e-mailed to a mailing list.	8
This e-mailing list can be subscribed to by anyone.	8
Project specifies how to set up external resources e.g. FTP servers, databases for tests.	8
Tests create their own files, database tables etc.	8
<b>Summary</b>	<b>11,6</b>

## DrEye

<b>Portability</b>	
To what extent can the software be used on other platforms?	42
Application can be built on and run under Windows.	92
Application can be built on and run under Windows 7.	100
Application can be built on and run under Windows XP.	67
Application can be built on and run under Windows Vista.	50
Application can be built on and run under UNIX/Linux.	8
Application can be built on and run under Solaris.	8
Application can be built on and run under RedHat.	17
Application can be built on and run under Debian.	8
Application can be built on and run under Fedora.	8
Application can be built on and run under Ubuntu.	8
Application can be built on and run under MacOSX.	8

Browser applications run under Internet Explorer.	17
Browser applications run under Mozilla Firefox.	25
Browser applications run under Google Chrome.	25
Browser applications run under Opera.	17
Browser applications run under Safari.	17
<b>Summary</b>	<b>30,4</b>

	<b>DrEye</b>
<b>Supportability</b>	
To what extent will the product be supported currently and in the future?	92
Web site has page describing how to get support.	42
User doc has page describing how to get support.	25
Software describes how to get support (in a README for command-line tools or a Help=>About window in a GUI).	33
Above pages/windows/files describe, or link to, a description of “how to ask for help” e.g. cite version number, send transcript, error logs etc.	17
Project has an e-mail address.	58
Project e-mail address has project domain name.	50
E-mails are read by more than one person.	17
E-mails are archived.	25
E-mail archives are publicly readable.	25
E-mail archives are searchable.	25
Project has a ticketing system.	17
Ticketing system is publicly readable.	8
Ticketing system is searchable.	8
Web site has site map or index.	42
Web site has search facility.	33
Project resources are hosted externally to a single organisation/institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of the current project.	17
E-mail archives or ticketing system shows that queries are responded to within a week (not necessarily fixed, but at least looked at and a decision taken as to their priority).	8
If there is a blog, is it is regularly used.	8
E-mail lists or forums, if present, have regular posts.	8
<b>Summary</b>	<b>27,9</b>

	DrEye
<b>Analysability</b>	
How straightforward is it to analyse the software's source release to:	
• To understand its implementation architecture?	25
• To understand individual source code files and how they fit into the implementation architecture?	25
Source code is structured into modules or packages.	33
Source code structure relates clearly to the architecture or design.	17
Project files for IDEs are provided.	8
Source code repository is a revision control system.	8
Structure of the source code repository and how this maps to the software's components is documented.	17
Source releases are snapshots of the repository.	17
Source code is commented.	8
Source code comments are written in an API document generation mark-up language e.g. JavaDoc or Doxygen.	8
Source code is laid out and indented well.	17
Source code uses sensible class, package and variable names.	17
There are no old source code files that should be handled by version control e.g. "SomeComponentOld.java".	8
There is no commented out code.	8
There are no TODOs in the code.	8
Auto-generated source code is in separate directories from other source code.	8
How to regenerate the auto-generated source code is documented.	8
Coding standards are recommended by the project.	8
Coding standards are required to be observed.	8
Project-specific coding standards are consistent with community or generic coding standards (e.g. for C, Java, FORTRAN etc.).	8
<b>Summary</b>	<b>13,2</b>

	DrEye
<b>Changeability</b>	

How straightforward is it to modify the software to:	
• Address issues?	25
• Modify functionality?	34
• Add new functionality?	50
Project has defined a contributions policy.	33
Contributions policy is publicly available.	42
Contributors retain copyright/IP of their contributions.	17
Users, user-developers and developers who are not project members can contribute.	50
Project has defined a stability/deprecation policy for components, APIs etc.	17
Stability/deprecation policy is publicly available.	17
Releases document deprecated components/APIs in that release.	8
Releases document removed/changed components/APIs in that release.	8
Changes in the source code repository are e-mailed to a mailing list.	8
This e-mailing list can be subscribed to by anyone.	8
<b>Summary</b>	<b>24,4</b>

DrEye

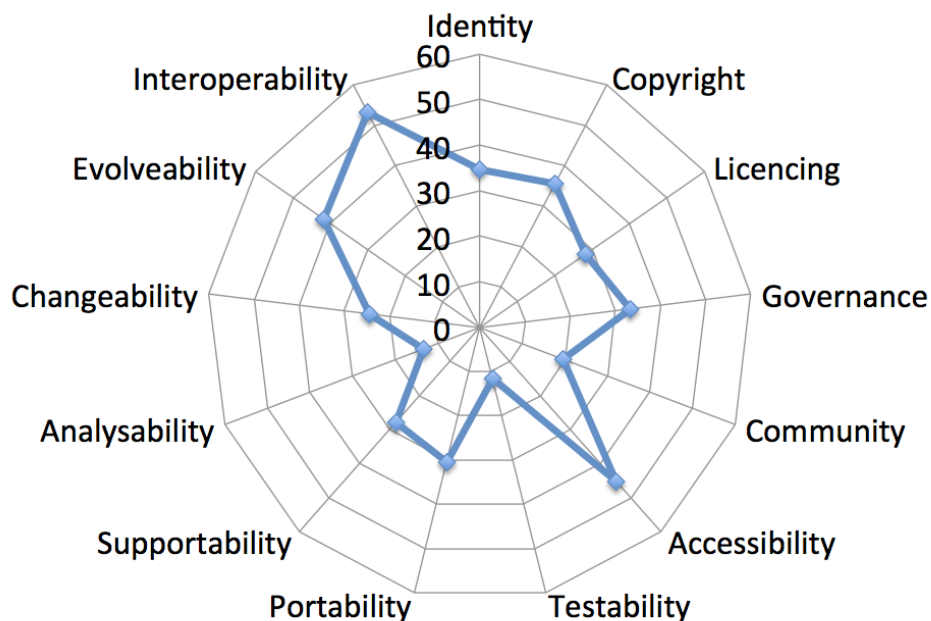
<b>Evolveability</b>	
To what extent will the product be developed in the future:	
• For a future release?	59
• Within a roadmap for the product?	41
Web site describes project roadmap or plans or milestones (either on a web page or within a ticketing system).	17
Web site describes how project is funded/sustained.	67
Web site describes end dates of current funding lines.	25
<b>Summary</b>	<b>41,8</b>

DrEye

<b>Interoperability</b>	
-------------------------	--

To what extent does the software's interoperability:	
• Meet appropriate open standards?	50
• Function with required third-party components?	59
• Function with optional third-party components?	50
Uses open standards.	59
Uses mature, ratified, non-draft open standards.	59
Provides tests demonstrating compliance to open standards.	42
<b>Summary</b>	<b>53,2</b>

In summary the sustainability & maintenance of DrEye is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



Most of the values are below 50% showing that there is a lack of sustainability and maintenance. One of the reasons for these results is also the fact that information about many of the items was missing by the evaluators, so that documentation about maintenance and sustainability needs to be improved.

In addition to the numbers the following comments were given:

**Identity:**

"Embarrassing hits" negative question ambiguous: no such hits but is this a yes or no answer?

**Testability:**

I'm not responsible for maintenance and testing - can't know the answer to Q1.

**Analysability:**

Have never seen Dr Eye source code - waste of time me answering "unknown" to everything.

**General comments regarding sustainability & maintenance:**

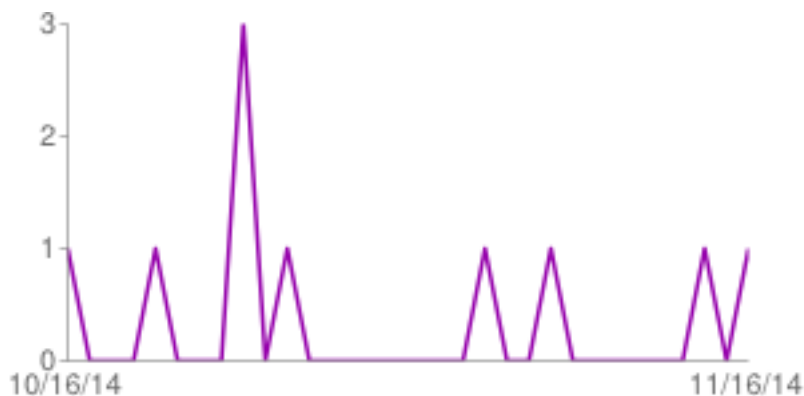
I didn't see the link for source code so sustainability and maintainability are on the shoulder of the original developer only.

**A detailed overview of usability and sustainability & maintenance for DrEye is online available:**

[https://docs.google.com/forms/d/1wxYCM\\_nCpUFry-Doyg\\_4ltfy\\_GgoaYLpGJWo0LCo21c/viewanalytics](https://docs.google.com/forms/d/1wxYCM_nCpUFry-Doyg_4ltfy_GgoaYLpGJWo0LCo21c/viewanalytics)

### 8.3 Evaluation of BraTumIA and brain segmentation

BraTumIA was evaluated by 10 endusers from the CHIC consortium. The evaluation did take place since the consortium meeting in Leuven in October 2014. The number of daily evaluations is given in the following figure:



#### 8.3.1 Results of Usability

According to the criteria for usability as finalized in D11.1 four major aspects of usability were analysed:

- Understandability
- Documentation
- Buildability
- Learnability

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	BraTumIA
<b>Understandability</b>	
How straightforward is it to understand:	
• What the software does and its purpose?	90
• The intended market and users of the software?	70
• The software's basic functions?	80
• The software's advanced functions?	60
High-level description of what/who the software is for is available.	80
High-level description of what the software does is available.	60
High-level description of how the software works is available.	50



Design rationale is available – why it does it the way it does.	40
Architectural overview, with diagrams, is available.	30
Descriptions of intended use cases are available.	60
Case studies of use are available.	60
<b>Summary</b>	<b>61,8</b>

	<b>BraTumIA</b>
<b>Documentation</b>	
Looking at the user documentation, what is its	90
<ul style="list-style-type: none"> <li>Quality?</li> </ul>	
<ul style="list-style-type: none"> <li>Completeness?</li> </ul>	90
<ul style="list-style-type: none"> <li>Accuracy?</li> </ul>	90
<ul style="list-style-type: none"> <li>Appropriateness?</li> </ul>	90
<ul style="list-style-type: none"> <li>Clarity?</li> </ul>	90
Provides a high-level overview of the software.	70
Partitioned into sections for users, user-developers and developers (depending on the software).	10
States assumed background and expertise of the reader, for each class of user.	30
Lists resources for further information.	60
Further information is suitable for the level of the reader, for each class of user.	30
Is task-oriented.	80
Consists of clear, step-by-step instructions.	80
Gives examples of what the user can see at each step e.g. screen shots or command-line excerpts.	70
For problems and error messages, the symptoms and step-by-step solutions are provided.	20
Does not use terms like “intuitive”, “user friendly”, “easy to use”, “simple” or “obviously”, unless as part of quotes from satisfied users	60
States command names and syntax, says what menus to use, lists parameters and error messages exactly as they appear or should be typed.	50
Uses <code>teletype-style</code> fonts for command-line inputs and outputs, source code fragments, function names, class names etc.	20
For Java, the package names of classes are stated the first time a class is mentioned.	0
English language descriptions of commands or errors are provided but only to complement the above.	50
Plain-text files (e.g. READMEs) use indentation and underlining (e.g. === and ---) to structure the text.	20
Plain-text files (e.g. READMEs) do not use TAB characters to indent the text.	10
API documentation e.g. JavaDoc or Doxygen, documents APIs completely e.g.	0

configuration files, property names etc.	
Is held under version control alongside the code.	0
Is on the project web site.	40
Documentation on the project web site makes it clear what version of the software the documentation applies to.	30
<b>Summary</b>	<b>47,2</b>

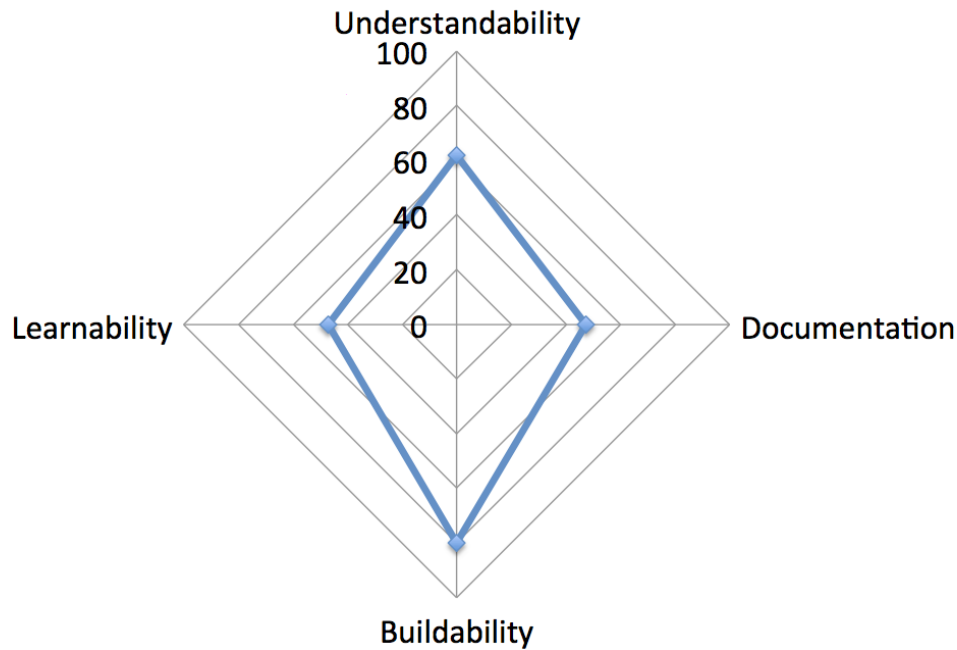
### BraTumIA

<b>Buildability</b>	
Was the tool stable running	100
Was the tool fast responding	60
<b>Summary</b>	<b>80</b>

### BraTumIA

<b>Learnability</b>	
How straightforward is it to learn how to achieve:	
• Basic functional tasks?	80
• Advanced functional tasks?	60
A getting started guide is provided outlining a basic example of using the software.	60
Instructions are provided for many basic use cases.	40
Instructions are provided supporting all use cases.	50
Reference guides are provided for all command-line, GUI and configuration options.	30
API documentation is provided for user-developers and developers.	10
<b>Summary</b>	<b>47,13</b>

In summary the usability of BraTumIA is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



In addition the following comments were given:

**Understandability:**

No comments are given.

**Documentation:**

No comments are given.

**Buildability:**

Using it in Virtual Machine is quite slow to respond

Slow response to simple actions (e.g. scrolling through slices) 16GB of RAM is enough to just get through the essentials at an average speed only. Processing times confirms the manual though (5mins required per patient).

**Learnability:**

No comments are given.

**General comments regarding usability:**

Good

After segmentation, nothing happens - user must click further options to see result. There needs to be an immediate indication that it worked.

Usability is good in general

Excellent!

Overall an easy to use application for medical professionals. Sufficient number of functions doing rather straightforward, clear and to-the-point actions

General

### 8.3.2 Results of sustainability and Maintenance

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	BraTumIA
<b>Identity</b>	
To what extent is the identity of the project/software clear and unique both within its application domain and generally?	30
Project/software has its own domain name.	50
Project/software has a logo.	50
Project/software has a distinct name within its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	50
Project/software has a distinct name regardless of its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	40
Project/software name does not throw up embarrassing “did you mean...” hits on Google.	0
Project/software name does not violate an existing trade-mark.	0
<b>Summary</b>	<b>31,4</b>

	BraTumIA
<b>Copyright</b>	
To what extent is it clear who wrote the software and owns its copyright?	50
Web site states copyright.	20
Web site states who developed/develops the software, funders etc.	60
If there are multiple web sites then these all state exactly the same copyright, licencing and authorship.	20
Each source code file has a copyright statement.	10
If supported by the language, each source code file has a copyright statement embedded within a constant.	0
Each source code file has a licence header.	0
<b>Summary</b>	<b>22,9</b>

	BraTumIA
<b>Licencing</b>	
Has an appropriate licence been adopted?	20
Web site states licence.	30
Software (source and binaries) has a licence.	10
Software has an open source licence.	30
Software has an Open Software Initiative <sup>6</sup> (OSI)-recognised licence.	0
<b>Summary</b>	<b>18</b>

	BraTumIA
<b>Governance</b>	
To what extent does the project make its management, or how its software development is managed, transparent?	40
Project has defined a governance policy.	0
Governance policy is publicly available.	0
<b>Summary</b>	<b>13,3</b>

	BraTumIA
<b>Community</b>	
To what extent does/will an active user community exist for this product?	60
Web site has statement of number of users/developers/members.	20
Web site has success stories.	10
Web site has quotes from satisfied users.	10
Web site has list of important partners or collaborators.	40
Web site has list of the project's publications.	50
Web site has list of third-party publications that cite the software.	10
Web site has list of software that uses/bundles this software.	0

<sup>6</sup> <http://www.opensource.org/>

Users are requested to cite the project if publishing papers based on results derived from the software.	50
Users are required to cite a boilerplate citation if publishing papers based on results derived from the software.	50
Users exist who are not members of the project.	30
Developers exist who are not members of the project.	10
<b>Summary</b>	<b>28,3</b>

	<b>BraTumIA</b>
<b>Accessibility</b>	
To what extent is the software accessible?	80
Binary distributions are available (whether for free, payment, registration).	30
Binary distributions are freely available.	30
Binary distributions are available without the need for any registration or authorisation of access by the project.	0
Source distributions are available (whether for free, payment, registration).	10
Source distributions are freely available.	10
Source distributions are available without the need for any registration or authorisation of access by the project.	0
Access to source code repository is available (whether for free, payment, registration).	0
Anonymous read-only access to source code repository.	0
Ability to browse source code repository online.	0
Repository is hosted externally to a single organisation/ institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of any current funding line.	0
Downloads page shows evidence of regular releases (e.g. six monthly, bi-weekly, etc.).	10
<b>Summary</b>	<b>14,2</b>

	<b>BraTumIA</b>
<b>Testability</b>	
How straightforward is it to test the software to verify modifications?	50
Project has unit tests.	30
Project has integration tests.	20
For GUIs, project uses automated GUI test frameworks.	0

Project has scripts for testing scenarios that have not been automated (e.g. for testing GUIs).	0
Project recommends tools to check conformance to coding standards.	0
Project has automated tests to check conformance to coding standards.	0
Project recommends tools to check test coverage.	0
Project has automated tests to check test coverage.	0
A minimum test coverage level that must be met has been defined.	0
There is an automated test for this minimum test coverage level.	0
Tests are automatically run nightly.	0
Continuous integration is supported – tests are automatically run whenever the source code changes.	0
Test results are visible to all developers/members.	0
Test results are visible publicly.	0
Test results are e-mailed to a mailing list.	0
This e-mailing list can be subscribed to by anyone.	1
Project specifies how to set up external resources e.g. FTP servers, databases for tests.	0
Tests create their own files, database tables etc.	0
<b>Summary</b>	<b>5,3</b>

## BraTumIA

<b>Portability</b>	
To what extent can the software be used on other platforms?	40
Application can be built on and run under Windows.	90
Application can be built on and run under Windows 7.	90
Application can be built on and run under Windows XP.	20
Application can be built on and run under Windows Vista.	10
Application can be built on and run under UNIX/Linux.	10
Application can be built on and run under Solaris.	0
Application can be built on and run under RedHat.	0
Application can be built on and run under Debian.	0
Application can be built on and run under Fedora.	0
Application can be built on and run under Ubuntu.	10
Application can be built on and run under MacOSX.	10

Browser applications run under Internet Explorer.	10
Browser applications run under Mozilla Firefox.	10
Browser applications run under Google Chrome.	10
Browser applications run under Opera.	0
Browser applications run under Safari.	0
<b>Summary</b>	<b>18,2</b>

### BraTumIA

<b>Supportability</b>	
To what extent will the product be supported currently and in the future?	40
Web site has page describing how to get support.	30
User doc has page describing how to get support.	20
Software describes how to get support (in a README for command-line tools or a Help=>About window in a GUI).	30
Above pages/windows/files describe, or link to, a description of “how to ask for help” e.g. cite version number, send transcript, error logs etc.	20
Project has an e-mail address.	70
Project e-mail address has project domain name.	10
E-mails are read by more than one person.	0
E-mails are archived.	0
E-mail archives are publicly readable.	0
E-mail archives are searchable.	0
Project has a ticketing system.	0
Ticketing system is publicly readable.	0
Ticketing system is searchable.	0
Web site has site map or index.	30
Web site has search facility.	20
Project resources are hosted externally to a single organisation/institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of the current project.	20
E-mail archives or ticketing system shows that queries are responded to within a week (not necessarily fixed, but at least looked at and a decision taken as to their priority).	0
If there is a blog, is it is regularly used.	0
E-mail lists or forums, if present, have regular posts.	0
<b>Summary</b>	<b>14,5</b>



	BraTumIA
<b>Analysability</b>	
How straightforward is it to analyse the software's source release to:	
• To understand its implementation architecture?	20
• To understand individual source code files and how they fit into the implementation architecture?	10
Source code is structured into modules or packages.	20
Source code structure relates clearly to the architecture or design.	20
Project files for IDEs are provided.	0
Source code repository is a revision control system.	10
Structure of the source code repository and how this maps to the software's components is documented.	10
Source releases are snapshots of the repository.	10
Source code is commented.	20
Source code comments are written in an API document generation mark-up language e.g. JavaDoc or Doxygen.	10
Source code is laid out and indented well.	20
Source code uses sensible class, package and variable names.	20
There are no old source code files that should be handled by version control e.g. "SomeComponentOld.java".	10
There is no commented out code.	0
There are no TODOs in the code.	0
Auto-generated source code is in separate directories from other source code.	0
How to regenerate the auto-generated source code is documented.	0
Coding standards are recommended by the project.	10
Coding standards are required to be observed.	0
Project-specific coding standards are consistent with community or generic coding standards (e.g. for C, Java, FORTRAN etc.).	10
<b>Summary</b>	<b>10</b>

	BraTumIA
<b>Changeability</b>	

How straightforward is it to modify the software to:	
• Address issues?	30
• Modify functionality?	40
• Add new functionality?	30
Project has defined a contributions policy.	30
Contributions policy is publicly available.	20
Contributors retain copyright/IP of their contributions.	10
Users, user-developers and developers who are not project members can contribute.	10
Project has defined a stability/deprecation policy for components, APIs etc.	10
Stability/deprecation policy is publicly available.	10
Releases document deprecated components/APIs in that release.	10
Releases document removed/changed components/APIs in that release.	10
Changes in the source code repository are e-mailed to a mailing list.	10
This e-mailing list can be subscribed to by anyone.	10
<b>Summary</b>	<b>17,7</b>

BraTumIA

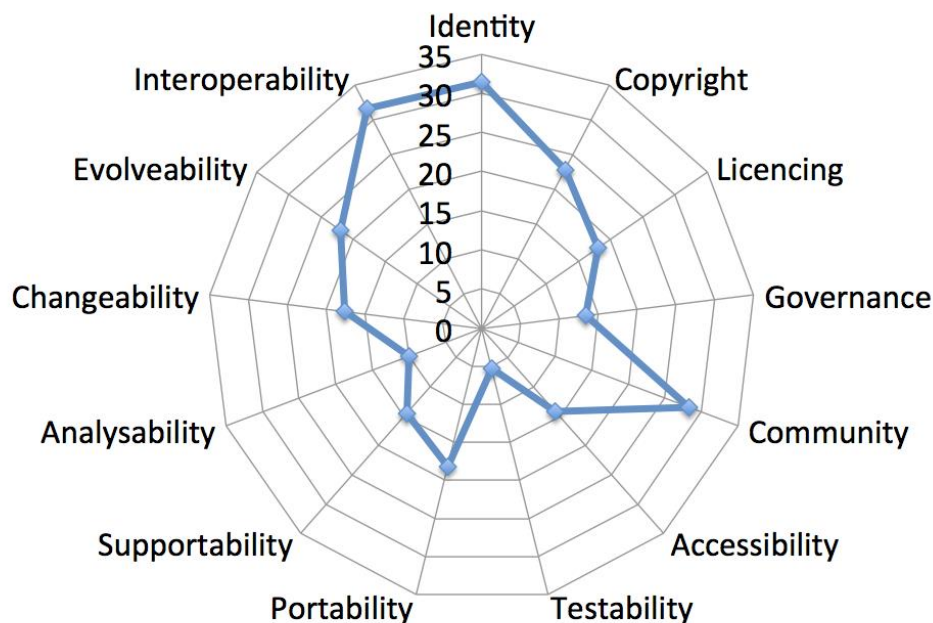
<b>Evolveability</b>	
To what extent will the product be developed in the future:	
• For a future release?	40
• Within a roadmap for the product?	40
Web site describes project roadmap or plans or milestones (either on a web page or within a ticketing system).	0
Web site describes how project is funded/sustained.	30
Web site describes end dates of current funding lines.	0
<b>Summary</b>	<b>22</b>

BraTumIA

<b>Interoperability</b>	
-------------------------	--

To what extent does the software's interoperability:	
• Meet appropriate open standards?	30
• Function with required third-party components?	30
• Function with optional third-party components?	40
Uses open standards.	30
Uses mature, ratified, non-draft open standards.	30
Provides tests demonstrating compliance to open standards.	30
<b>Summary</b>	<b>31,7</b>

In summary the sustainability & maintenance of BraTumIA is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



All of the values are below 40% showing that there is a lack of sustainability and maintenance. One of the reasons for these results is also the fact that information about many of the items was missing by the evaluators, so that documentation about maintenance and sustainability needs to be improved.

In addition to the numbers the following comments were given:

**General comments regarding sustainability & maintenance:**

Sustainability is good in general.

Fair

**A detailed overview of usability and sustainability & maintenance for BraTumIA is online available:**

<https://docs.google.com/forms/d/14vtbaXbQR0HCEwGYF4IPtXCuUwf-5Ekxxf6O9RukKt0/viewanalytics>

## 8.4 Evaluation of CCGVis and volume rendering

CCGVis was evaluated by 8 endusers from the CHIC consortium. The evaluation did take place since the consortium meeting in Leuven in October 2014. The number of daily evaluations is given in the following figure:



### 8.4.1 Results of Usability

According to the criteria for usability as finalized in D11.1 four major aspects of usability were analysed:

- Understandability
- Documentation
- Buildability
- Learnability

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	CCGVIS
<b>Understandability</b>	
How straightforward is it to understand:	
• What the software does and its purpose?	76
• The intended market and users of the software?	63
• The software's basic functions?	88
• The software's advanced functions?	75
High-level description of what/who the software is for is available.	63
High-level description of what the software does is available.	63
High-level description of how the software works is available.	50

Design rationale is available – why it does it the way it does.	38
Architectural overview, with diagrams, is available.	25
Descriptions of intended use cases are available.	25
Case studies of use are available.	13
<b>Summary</b>	<b>52,6</b>

	<b>CCGVIS</b>
<b>Documentation</b>	
Looking at the user documentation, what is its	87
<ul style="list-style-type: none"> <li>Quality?</li> </ul>	100
<ul style="list-style-type: none"> <li>Completeness?</li> </ul>	100
<ul style="list-style-type: none"> <li>Accuracy?</li> </ul>	100
<ul style="list-style-type: none"> <li>Appropriateness?</li> </ul>	100
<ul style="list-style-type: none"> <li>Clarity?</li> </ul>	100
Provides a high-level overview of the software.	63
Partitioned into sections for users, user-developers and developers (depending on the software).	25
States assumed background and expertise of the reader, for each class of user.	38
Lists resources for further information.	13
Further information is suitable for the level of the reader, for each class of user.	25
Is task-oriented.	38
Consists of clear, step-by-step instructions.	63
Gives examples of what the user can see at each step e.g. screen shots or command-line excerpts.	50
For problems and error messages, the symptoms and step-by-step solutions are provided.	25
Does not use terms like “intuitive”, “user friendly”, “easy to use”, “simple” or “obviously”, unless as part of quotes from satisfied users	38
States command names and syntax, says what menus to use, lists parameters and error messages exactly as they appear or should be typed.	13
Uses <code>teletype-style</code> fonts for command-line inputs and outputs, source code fragments, function names, class names etc.	13
For Java, the package names of classes are stated the first time a class is mentioned.	0
English language descriptions of commands or errors are provided but only to complement the above.	13
Plain-text files (e.g. READMEs) use indentation and underlining (e.g. === and ---) to structure the text.	0
Plain-text files (e.g. READMEs) do not use TAB characters to indent the text.	0
API documentation e.g. JavaDoc or Doxygen, documents APIs completely e.g.	0

configuration files, property names etc.	
Is held under version control alongside the code.	0
Is on the project web site.	0
Documentation on the project web site makes it clear what version of the software the documentation applies to.	0
<b>Summary</b>	<b>36,16</b>

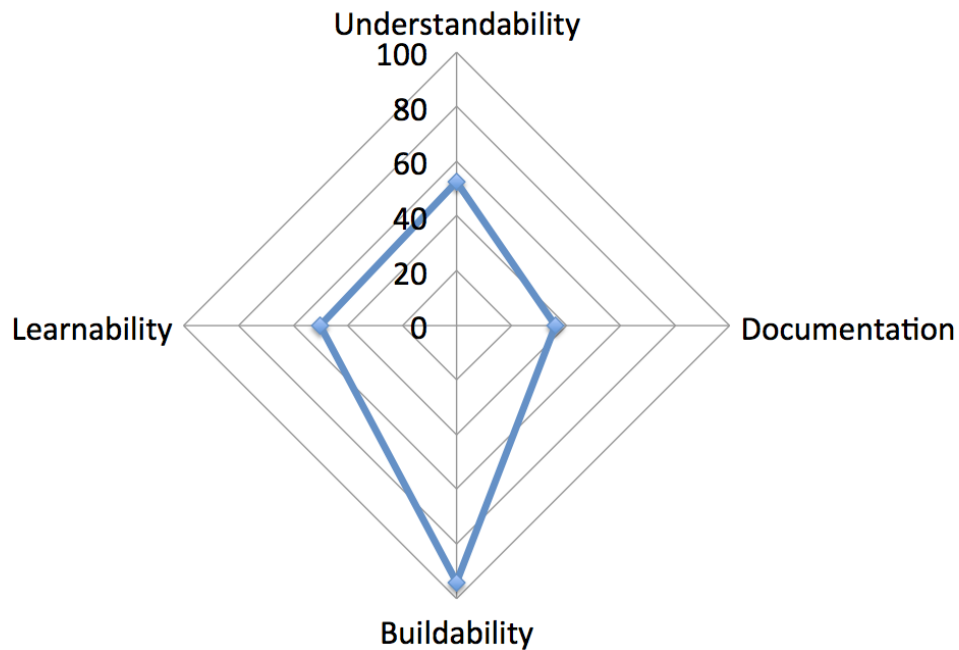
### CCGVIS

<b>Buildability</b>	
Was the tool stable running	100
Was the tool fast responding	88
<b>Summary</b>	<b>94</b>

### CCGVIS

<b>Learnability</b>	
How straightforward is it to learn how to achieve:	
• Basic functional tasks?	88
• Advanced functional tasks?	75
A getting started guide is provided outlining a basic example of using the software.	75
Instructions are provided for many basic use cases.	38
Instructions are provided supporting all use cases.	38
Reference guides are provided for all command-line, GUI and configuration options.	25
API documentation is provided for user-developers and developers.	13
<b>Summary</b>	<b>50,3</b>

In summary the usability of CCGVis is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



In addition the following comments were given:

**Understandability:**

Not sure the main purpose of volume rendering  
Very simple to understand

**Documentation:**

No comments are given.

**Buildability:**

We used it in virtual machine, so it is bit slow to responding

**Learnability:**

Generally is good

**General comments regarding usability:**

Good, apart from transfer function  
Usability is good in general  
There are functions that cannot be used, so they should not be shown. Many of the functionalities are not intuitive. Missing help function, Needs to be integrated into another platform like DrEye



## 8.4.2 Results of sustainability and Maintenance

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	CCGVIS
<b>Identity</b>	
To what extent is the identity of the project/software clear and unique both within its application domain and generally?	25
Project/software has its own domain name.	25
Project/software has a logo.	25
Project/software has a distinct name within its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	25
Project/software has a distinct name regardless of its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	25
Project/software name does not throw up embarrassing “did you mean...” hits on Google.	0
Project/software name does not violate an existing trade-mark.	0
<b>Summary</b>	<b>17,9</b>

	CCGVIS
<b>Copyright</b>	
To what extent is it clear who wrote the software and owns its copyright?	63
Web site states copyright.	0
Web site states who developed/develops the software, funders etc.	13
If there are multiple web sites then these all state exactly the same copyright, licencing and authorship.	0
Each source code file has a copyright statement.	0
If supported by the language, each source code file has a copyright statement embedded within a constant.	0
Each source code file has a licence header.	0
<b>Summary</b>	<b>10,9</b>

	CCGVIS
<b>Licencing</b>	
Has an appropriate licence been adopted?	0
Web site states licence.	0
Software (source and binaries) has a licence.	0
Software has an open source licence.	0
Software has an Open Software Initiative <sup>7</sup> (OSI)-recognised licence.	0
<b>Summary</b>	<b>0,0</b>

	CCGVIS
<b>Governance</b>	
To what extent does the project make its management, or how its software development is managed, transparent?	25
Project has defined a governance policy.	0
Governance policy is publicly available.	0
<b>Summary</b>	<b>8,3</b>

	CCGVIS
<b>Community</b>	
To what extent does/will an active user community exist for this product?	51
Web site has statement of number of users/developers/members.	25
Web site has success stories.	13
Web site has quotes from satisfied users.	25
Web site has list of important partners or collaborators.	25
Web site has list of the project's publications.	25
Web site has list of third-party publications that cite the software.	25
Web site has list of software that uses/bundles this software.	13

<sup>7</sup> <http://www.opensource.org/>

Users are requested to cite the project if publishing papers based on results derived from the software.	25
Users are required to cite a boilerplate citation if publishing papers based on results derived from the software.	25
Users exist who are not members of the project.	13
Developers exist who are not members of the project.	13
<b>Summary</b>	<b>23,2</b>

	<b>CCGVIS</b>
<b>Accessibility</b>	
To what extent is the software accessible?	63
Binary distributions are available (whether for free, payment, registration).	13
Binary distributions are freely available.	0
Binary distributions are available without the need for any registration or authorisation of access by the project.	0
Source distributions are available (whether for free, payment, registration).	0
Source distributions are freely available.	0
Source distributions are available without the need for any registration or authorisation of access by the project.	0
Access to source code repository is available (whether for free, payment, registration).	0
Anonymous read-only access to source code repository.	0
Ability to browse source code repository online.	0
Repository is hosted externally to a single organisation/ institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of any current funding line.	0
Downloads page shows evidence of regular releases (e.g. six monthly, bi-weekly, etc.).	0
<b>Summary</b>	<b>6,3</b>

	<b>CCGVIS</b>
<b>Testability</b>	
How straightforward is it to test the software to verify modifications?	38
Project has unit tests.	13
Project has integration tests.	13
For GUIs, project uses automated GUI test frameworks.	13

Project has scripts for testing scenarios that have not been automated (e.g. for testing GUIs).	13
Project recommends tools to check conformance to coding standards.	13
Project has automated tests to check conformance to coding standards.	13
Project recommends tools to check test coverage.	13
Project has automated tests to check test coverage.	0
A minimum test coverage level that must be met has been defined.	0
There is an automated test for this minimum test coverage level.	0
Tests are automatically run nightly.	0
Continuous integration is supported – tests are automatically run whenever the source code changes.	0
Test results are visible to all developers/members.	0
Test results are visible publicly.	0
Test results are e-mailed to a mailing list.	13
This e-mailing list can be subscribed to by anyone.	0
Project specifies how to set up external resources e.g. FTP servers, databases for tests.	0
Tests create their own files, database tables etc.	0
<b>Summary</b>	<b>7,5</b>

	<b>CCGVIS</b>
<b>Portability</b>	
To what extent can the software be used on other platforms?	25
Application can be built on and run under Windows.	100
Application can be built on and run under Windows 7.	88
Application can be built on and run under Windows XP.	50
Application can be built on and run under Windows Vista.	25
Application can be built on and run under UNIX/Linux.	13
Application can be built on and run under Solaris.	0
Application can be built on and run under RedHat.	0
Application can be built on and run under Debian.	0
Application can be built on and run under Fedora.	0
Application can be built on and run under Ubuntu.	13
Application can be built on and run under MacOSX.	13

Browser applications run under Internet Explorer.	13
Browser applications run under Mozilla Firefox.	13
Browser applications run under Google Chrome.	13
Browser applications run under Opera.	0
Browser applications run under Safari.	0
<b>Summary</b>	<b>21,5</b>

	<b>CCGVIS</b>
<b>Supportability</b>	
To what extent will the product be supported currently and in the future?	50
Web site has page describing how to get support.	13
User doc has page describing how to get support.	25
Software describes how to get support (in a README for command-line tools or a Help=>About window in a GUI).	25
Above pages/windows/files describe, or link to, a description of “how to ask for help” e.g. cite version number, send transcript, error logs etc.	25
Project has an e-mail address.	25
Project e-mail address has project domain name.	13
E-mails are read by more than one person.	0
E-mails are archived.	0
E-mail archives are publicly readable.	0
E-mail archives are searchable.	0
Project has a ticketing system.	0
Ticketing system is publicly readable.	0
Ticketing system is searchable.	0
Web site has site map or index.	0
Web site has search facility.	0
Project resources are hosted externally to a single organisation/institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of the current project.	0
E-mail archives or ticketing system shows that queries are responded to within a week (not necessarily fixed, but at least looked at and a decision taken as to their priority).	0
If there is a blog, is it is regularly used.	0
E-mail lists or forums, if present, have regular posts.	0
<b>Summary</b>	<b>8,8</b>

	CCGVIS
<b>Analysability</b>	
How straightforward is it to analyse the software's source release to:	
• To understand its implementation architecture?	25
• To understand individual source code files and how they fit into the implementation architecture?	25
Source code is structured into modules or packages.	25
Source code structure relates clearly to the architecture or design.	25
Project files for IDEs are provided.	13
Source code repository is a revision control system.	0
Structure of the source code repository and how this maps to the software's components is documented.	13
Source releases are snapshots of the repository.	13
Source code is commented.	25
Source code comments are written in an API document generation mark-up language e.g. JavaDoc or Doxygen.	0
Source code is laid out and indented well.	25
Source code uses sensible class, package and variable names.	13
There are no old source code files that should be handled by version control e.g. "SomeComponentOld.java".	0
There is no commented out code.	0
There are no TODOs in the code.	0
Auto-generated source code is in separate directories from other source code.	0
How to regenerate the auto-generated source code is documented.	0
Coding standards are recommended by the project.	0
Coding standards are required to be observed.	0
Project-specific coding standards are consistent with community or generic coding standards (e.g. for C, Java, FORTRAN etc.).	0
<b>Summary</b>	<b>10,1</b>

	CCGVIS
<b>Changeability</b>	

How straightforward is it to modify the software to:	
• Address issues?	50
• Modify functionality?	38
• Add new functionality?	38
Project has defined a contributions policy.	13
Contributions policy is publicly available.	0
Contributors retain copyright/IP of their contributions.	0
Users, user-developers and developers who are not project members can contribute.	13
Project has defined a stability/deprecation policy for components, APIs etc.	0
Stability/deprecation policy is publicly available.	0
Releases document deprecated components/APIs in that release.	0
Releases document removed/changed components/APIs in that release.	0
Changes in the source code repository are e-mailed to a mailing list.	0
This e-mailing list can be subscribed to by anyone.	0
<b>Summary</b>	<b>11,7</b>

### CCGVIS

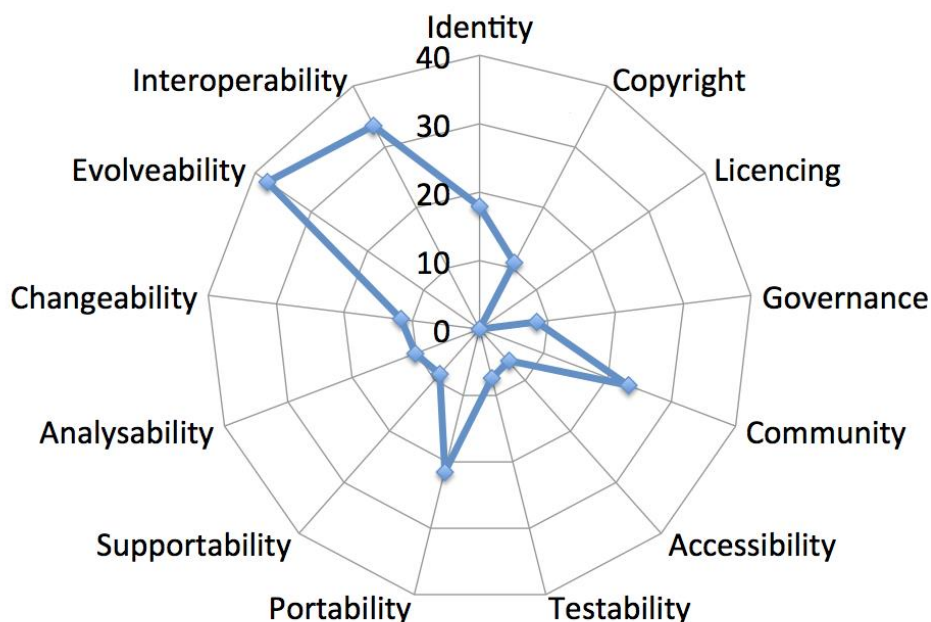
<b>Evolveability</b>	
To what extent will the product be developed in the future:	
• For a future release?	63
• Within a roadmap for the product?	50
Web site describes project roadmap or plans or milestones (either on a web page or within a ticketing system).	13
Web site describes how project is funded/sustained.	50
Web site describes end dates of current funding lines.	13
<b>Summary</b>	<b>37,8</b>

### CCGVIS

<b>Interoperability</b>	
-------------------------	--

To what extent does the software's interoperability:	
• Meet appropriate open standards?	38
• Function with required third-party components?	38
• Function with optional third-party components?	50
Uses open standards.	25
Uses mature, ratified, non-draft open standards.	25
Provides tests demonstrating compliance to open standards.	25
<b>Summary</b>	<b>33,5</b>

In summary the sustainability & maintenance of CCGVis is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



All of the values are below 40% showing that there is a lack of sustainability and maintenance. One of the reasons for these results is also the fact that information about many of the items was missing by the evaluators, so that documentation about maintenance and sustainability needs to be improved.

In addition to the numbers the following comments were given:

**General comments regarding sustainability & maintenance:**

Sustainability is good in general.

Not discussed at all

Generally satisfied



**A detailed overview of usability and sustainability & maintenance is online available:**

[https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF\\_W0y0KikAvgphztv0/viewanalytics](https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF_W0y0KikAvgphztv0/viewanalytics)

## 8.5 Evaluation of Timeline and clinical data repository

Timeline and clinical data repository was evaluated by 12 endusers from the CHIC consortium. The evaluation did take place since the consortium meeting in Leuven in October 2014. The number of daily evaluations is given in the following figure:



### 8.5.1 Results of Usability

According to the criteria for usability as finalized in D11.1 four major aspects of usability were analysed:

- Understandability
- Documentation
- Buildability
- Learnability

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	Timeline % Data Repository
<b>Understandability</b>	
How straightforward is it to understand:	
• What the software does and its purpose?	100
• The intended market and users of the software?	92
• The software's basic functions?	100
• The software's advanced functions?	67
High-level description of what/who the software is for is available.	33
High-level description of what the software does is available.	25

High-level description of how the software works is available.	33
Design rationale is available – why it does it the way it does.	33
Architectural overview, with diagrams, is available.	25
Descriptions of intended use cases are available.	33
Case studies of use are available.	25
<b>Summary</b>	<b>51,4</b>

### Timeline % Data Repository

<b>Documentation</b>	
Looking at the user documentation, what is its	75
<ul style="list-style-type: none"> <li>Quality?</li> </ul>	75
<ul style="list-style-type: none"> <li>Completeness?</li> </ul>	83
<ul style="list-style-type: none"> <li>Accuracy?</li> </ul>	83
<ul style="list-style-type: none"> <li>Appropriateness?</li> </ul>	75
<ul style="list-style-type: none"> <li>Clarity?</li> </ul>	33
Provides a high-level overview of the software.	8
Partitioned into sections for users, user-developers and developers (depending on the software).	17
States assumed background and expertise of the reader, for each class of user.	8
Lists resources for further information.	17
Further information is suitable for the level of the reader, for each class of user.	42
Is task-oriented.	50
Consists of clear, step-by-step instructions.	58
Gives examples of what the user can see at each step e.g. screen shots or command-line excerpts.	0
For problems and error messages, the symptoms and step-by-step solutions are provided.	33
Does not use terms like “intuitive”, “user friendly”, “easy to use”, “simple” or “obviously”, unless as part of quotes from satisfied users	17
States command names and syntax, says what menus to use, lists parameters and error messages exactly as they appear or should be typed.	0
Uses teletype-style fonts for command-line inputs and outputs, source code fragments, function names, class names etc.	0
For Java, the package names of classes are stated the first time a class is mentioned.	8
English language descriptions of commands or errors are provided but only to complement the above.	0
Plain-text files (e.g. READMEs) use indentation and underlining (e.g. === and ---) to structure the text.	0
Plain-text files (e.g. READMEs) do not use TAB characters to indent the text.	0

API documentation e.g. JavaDoc or Doxygen, documents APIs completely e.g. configuration files, property names etc.	0
Is held under version control alongside the code.	8
Is on the project web site.	17
Documentation on the project web site makes it clear what version of the software the documentation applies to.	8
<b>Summary</b>	<b>28,6</b>

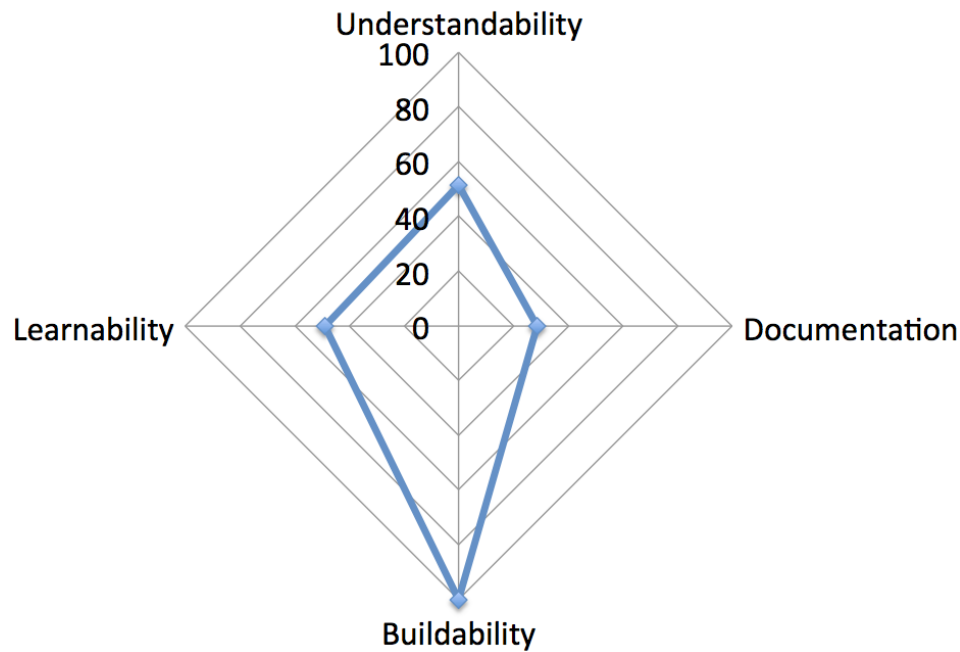
### Timeline % Data Repository

<b>Buildability</b>	
Was the tool stable running	100
Was the tool fast responding	100
<b>Summary</b>	<b>100</b>

### Timeline % Data Repository

<b>Learnability</b>	
How straightforward is it to learn how to achieve:	
• Basic functional tasks?	92
• Advanced functional tasks?	84
A getting started guide is provided outlining a basic example of using the software.	50
Instructions are provided for many basic use cases.	50
Instructions are provided supporting all use cases.	25
Reference guides are provided for all command-line, GUI and configuration options.	17
API documentation is provided for user-developers and developers.	25
<b>Summary</b>	<b>49,0</b>

In summary the usability of the Timeline and clinical data repository is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



In addition the following comments were given:

**Understandability:**

Manual in D11.2 is the only information. So only information on how to use it, nothing else is explained (although for an end-user this might be enough).

**Documentation:**

Same remark as previously.

I couldn't find any documentation for the tool (except for the information given in D11.2)

**Buildability:**

Very good

**Learnability:**

The tool is easy to learn but it would be easier if the getting started guide was provided

**General comments regarding usability:**

Good

Very easy to use

Nice to use.

The tool is really well designed and it is easy to understand what any button do and in which section of the tool the user uses any moment.

Usability is good in general

## 8.5.2 Results of sustainability and Maintenance

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	Timeline % Data Repository
<b>Identity</b>	
To what extent is the identity of the project/software clear and unique both within its application domain and generally?	25
Project/software has its own domain name.	50
Project/software has a logo.	17
Project/software has a distinct name within its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	8
Project/software has a distinct name regardless of its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	17
Project/software name does not throw up embarrassing “did you mean...” hits on Google.	0
Project/software name does not violate an existing trade-mark.	8
<b>Summary</b>	<b>17,9</b>

	Timeline % Data Repository
<b>Copyright</b>	
To what extent is it clear who wrote the software and owns its copyright?	8
Web site states copyright.	17
Web site states who developed/develops the software, funders etc.	50
If there are multiple web sites then these all state exactly the same copyright, licencing and authorship.	0
Each source code file has a copyright statement.	0
If supported by the language, each source code file has a copyright statement embedded within a constant.	0
Each source code file has a licence header.	0
<b>Summary</b>	<b>10,7</b>

	Timeline % Data Repository
<b>Licencing</b>	
Has an appropriate licence been adopted?	0
Web site states licence.	8
Software (source and binaries) has a licence.	25
Software has an open source licence.	17
Software has an Open Software Initiative <sup>8</sup> (OSI)-recognised licence.	8
<b>Summary</b>	<b>11,6</b>

	Timeline % Data Repository
<b>Governance</b>	
To what extent does the project make its management, or how its software development is managed, transparent?	42
Project has defined a governance policy.	17
Governance policy is publicly available.	17
<b>Summary</b>	<b>25,3</b>

	Timeline % Data Repository
<b>Community</b>	
To what extent does/will an active user community exist for this product?	58
Web site has statement of number of users/developers/members.	17
Web site has success stories.	0
Web site has quotes from satisfied users.	17
Web site has list of important partners or collaborators.	42
Web site has list of the project's publications.	25
Web site has list of third-party publications that cite the software.	0
Web site has list of software that uses/bundles this software.	17

<sup>8</sup> <http://www.opensource.org/>

Users are requested to cite the project if publishing papers based on results derived from the software.	17
Users are required to cite a boilerplate citation if publishing papers based on results derived from the software.	0
Users exist who are not members of the project.	17
Developers exist who are not members of the project.	0
<b>Summary</b>	<b>17,5</b>

### Timeline % Data Repository

<b>Accessibility</b>	
To what extent is the software accessible?	84
Binary distributions are available (whether for free, payment, registration).	17
Binary distributions are freely available.	0
Binary distributions are available without the need for any registration or authorisation of access by the project.	0
Source distributions are available (whether for free, payment, registration).	0
Source distributions are freely available.	0
Source distributions are available without the need for any registration or authorisation of access by the project.	0
Access to source code repository is available (whether for free, payment, registration).	0
Anonymous read-only access to source code repository.	0
Ability to browse source code repository online.	0
Repository is hosted externally to a single organisation/ institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of any current funding line.	17
Downloads page shows evidence of regular releases (e.g. six monthly, bi-weekly, etc.).	0
<b>Summary</b>	<b>9,8</b>

### Timeline % Data Repository

<b>Testability</b>	
How straightforward is it to test the software to verify modifications?	58
Project has unit tests.	42
Project has integration tests.	33
For GUIs, project uses automated GUI test frameworks.	0



Project has scripts for testing scenarios that have not been automated (e.g. for testing GUIs).	0
Project recommends tools to check conformance to coding standards.	0
Project has automated tests to check conformance to coding standards.	0
Project recommends tools to check test coverage.	8
Project has automated tests to check test coverage.	0
A minimum test coverage level that must be met has been defined.	0
There is an automated test for this minimum test coverage level.	8
Tests are automatically run nightly.	0
Continuous integration is supported – tests are automatically run whenever the source code changes.	0
Test results are visible to all developers/members.	17
Test results are visible publicly.	0
Test results are e-mailed to a mailing list.	8
This e-mailing list can be subscribed to by anyone.	0
Project specifies how to set up external resources e.g. FTP servers, databases for tests.	0
Tests create their own files, database tables etc.	0
<b>Summary</b>	<b>9,2</b>

### Timeline % Data Repository

<b>Portability</b>	
To what extent can the software be used on other platforms?	50
Application can be built on and run under Windows.	75
Application can be built on and run under Windows 7.	58
Application can be built on and run under Windows XP.	33
Application can be built on and run under Windows Vista.	25
Application can be built on and run under UNIX/Linux.	17
Application can be built on and run under Solaris.	8
Application can be built on and run under RedHat.	8
Application can be built on and run under Debian.	8
Application can be built on and run under Fedora.	8
Application can be built on and run under Ubuntu.	17
Application can be built on and run under MacOSX.	17

Browser applications run under Internet Explorer.	33
Browser applications run under Mozilla Firefox.	50
Browser applications run under Google Chrome.	50
Browser applications run under Opera.	17
Browser applications run under Safari.	17
<b>Summary</b>	<b>50,0</b>

### Timeline % Data Repository

<b>Supportability</b>	
To what extent will the product be supported currently and in the future?	50
Web site has page describing how to get support.	58
User doc has page describing how to get support.	25
Software describes how to get support (in a README for command-line tools or a Help=>About window in a GUI).	17
Above pages/windows/files describe, or link to, a description of “how to ask for help” e.g. cite version number, send transcript, error logs etc.	25
Project has an e-mail address.	58
Project e-mail address has project domain name.	33
E-mails are read by more than one person.	25
E-mails are archived.	17
E-mail archives are publicly readable.	0
E-mail archives are searchable.	0
Project has a ticketing system.	25
Ticketing system is publicly readable.	25
Ticketing system is searchable.	25
Web site has site map or index.	8
Web site has search facility.	33
Project resources are hosted externally to a single organisation/institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of the current project.	8
E-mail archives or ticketing system shows that queries are responded to within a week (not necessarily fixed, but at least looked at and a decision taken as to their priority).	0
If there is a blog, is it is regularly used.	0
E-mail lists or forums, if present, have regular posts.	8
<b>Summary</b>	<b>22</b>

	Timeline % Data Repository
<b>Analysability</b>	
How straightforward is it to analyse the software's source release to:	
• To understand its implementation architecture?	33
• To understand individual source code files and how they fit into the implementation architecture?	25
Source code is structured into modules or packages.	8
Source code structure relates clearly to the architecture or design.	8
Project files for IDEs are provided.	0
Source code repository is a revision control system.	17
Structure of the source code repository and how this maps to the software's components is documented.	8
Source releases are snapshots of the repository.	8
Source code is commented.	8
Source code comments are written in an API document generation mark-up language e.g. JavaDoc or Doxygen.	8
Source code is laid out and indented well.	25
Source code uses sensible class, package and variable names.	17
There are no old source code files that should be handled by version control e.g. "SomeComponentOld.java".	8
There is no commented out code.	0
There are no TODOs in the code.	0
Auto-generated source code is in separate directories from other source code.	8
How to regenerate the auto-generated source code is documented.	8
Coding standards are recommended by the project.	0
Coding standards are required to be observed.	0
Project-specific coding standards are consistent with community or generic coding standards (e.g. for C, Java, FORTRAN etc.).	0
<b>Summary</b>	<b>9,45</b>

	Timeline % Data Repository
<b>Changeability</b>	

How straightforward is it to modify the software to:	
• Address issues?	25
• Modify functionality?	25
• Add new functionality?	25
Project has defined a contributions policy.	0
Contributions policy is publicly available.	0
Contributors retain copyright/IP of their contributions.	0
Users, user-developers and developers who are not project members can contribute.	0
Project has defined a stability/deprecation policy for components, APIs etc.	8
Stability/deprecation policy is publicly available.	8
Releases document deprecated components/APIs in that release.	8
Releases document removed/changed components/APIs in that release.	8
Changes in the source code repository are e-mailed to a mailing list.	0
This e-mailing list can be subscribed to by anyone.	0
<b>Summary</b>	<b>8,2</b>

### Timeline % Data Repository

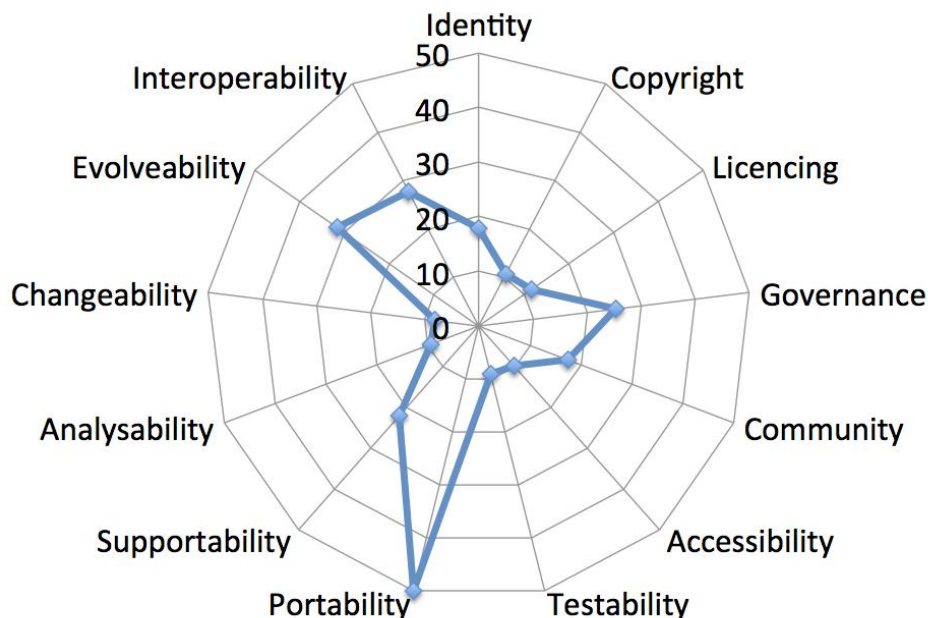
<b>Evolveability</b>	
To what extent will the product be developed in the future:	
• For a future release?	50
• Within a roadmap for the product?	33
Web site describes project roadmap or plans or milestones (either on a web page or within a ticketing system).	17
Web site describes how project is funded/sustained.	50
Web site describes end dates of current funding lines.	8
<b>Summary</b>	<b>31,6</b>

### Timeline % Data Repository

<b>Interoperability</b>	
-------------------------	--

To what extent does the software's interoperability:	
• Meet appropriate open standards?	33
• Function with required third-party components?	33
• Function with optional third-party components?	25
Uses open standards.	33
Uses mature, ratified, non-draft open standards.	17
Provides tests demonstrating compliance to open standards.	25
<b>Summary</b>	<b>27,7</b>

In summary the sustainability & maintenance of the Timeline and clinical data repository is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



Most of the values are below 50% and even below 30% showing that there is a lack of sustainability and maintenance. One of the reasons for these results is also the fact that information about many of the items was missing by the evaluators, so that documentation about maintenance and sustainability needs to be improved.

In addition to the numbers the following comments were given:

**Identity:**

Within the project, everyone knows what is referred to when the name is used.

**General comments regarding sustainability & maintenance:**

sustainability is good in general.

Good

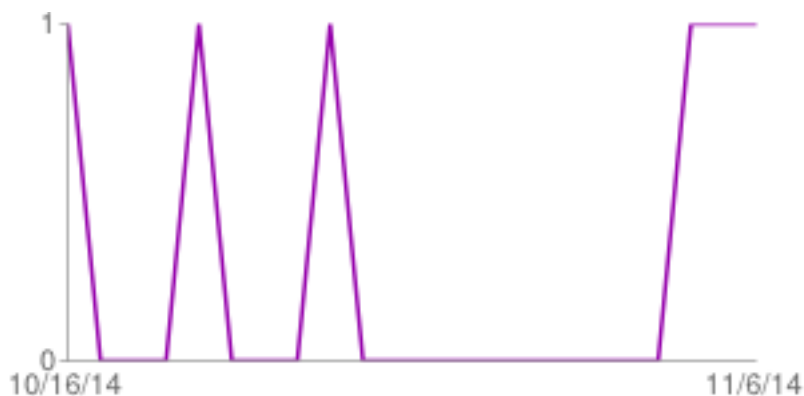
Useful tool so hopefully good sustainability

**A detailed overview of usability and sustainability & maintenance of the Timeline and clinical data repository is online available:**

[https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b\\_1xAwVB7\\_zF4Q01DPC470Jd2U/viewanalytics](https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b_1xAwVB7_zF4Q01DPC470Jd2U/viewanalytics)

## 8.6 Evaluation of Upload tool

The Upload Tool was evaluated by only 6 endusers from the CHIC consortium. The evaluation did take place since the consortium meeting in Leuven in October 2014. The number of daily evaluations is given in the following figure:



### 8.6.1 Results of Usability

According to the criteria for usability as finalized in D11.1 four major aspects of usability were analysed:

- Understandability
- Documentation
- Buildability
- Learnability

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	Upload Tool
<b>Understandability</b>	
How straightforward is it to understand:	
• What the software does and its purpose?	83
• The intended market and users of the software?	83
• The software's basic functions?	83
• The software's advanced functions?	67
High-level description of what/who the software is for is available.	33
High-level description of what the software does is available.	33

High-level description of how the software works is available.	33
Design rationale is available – why it does it the way it does.	33
Architectural overview, with diagrams, is available.	17
Descriptions of intended use cases are available.	33
Case studies of use are available.	50
<b>Summary</b>	<b>49,8</b>

	<b>Upload Tool</b>
<b>Documentation</b>	
Looking at the user documentation, what is its	84
<ul style="list-style-type: none"> <li>Quality?</li> </ul>	84
<ul style="list-style-type: none"> <li>Completeness?</li> </ul>	84
<ul style="list-style-type: none"> <li>Accuracy?</li> </ul>	84
<ul style="list-style-type: none"> <li>Appropriateness?</li> </ul>	84
<ul style="list-style-type: none"> <li>Clarity?</li> </ul>	67
Provides a high-level overview of the software.	17
Partitioned into sections for users, user-developers and developers (depending on the software).	33
States assumed background and expertise of the reader, for each class of user.	17
Lists resources for further information.	17
Further information is suitable for the level of the reader, for each class of user.	0
Is task-oriented.	50
Consists of clear, step-by-step instructions.	17
Gives examples of what the user can see at each step e.g. screen shots or command-line excerpts.	17
For problems and error messages, the symptoms and step-by-step solutions are provided.	0
Does not use terms like “intuitive”, “user friendly”, “easy to use”, “simple” or “obviously”, unless as part of quotes from satisfied users	33
States command names and syntax, says what menus to use, lists parameters and error messages exactly as they appear or should be typed.	33
Uses teletype-style fonts for command-line inputs and outputs, source code fragments, function names, class names etc.	0
For Java, the package names of classes are stated the first time a class is mentioned.	0
English language descriptions of commands or errors are provided but only to complement the above.	33
Plain-text files (e.g. READMEs) use indentation and underlining (e.g. === and ---) to structure the text.	0
Plain-text files (e.g. READMEs) do not use TAB characters to indent the text.	0

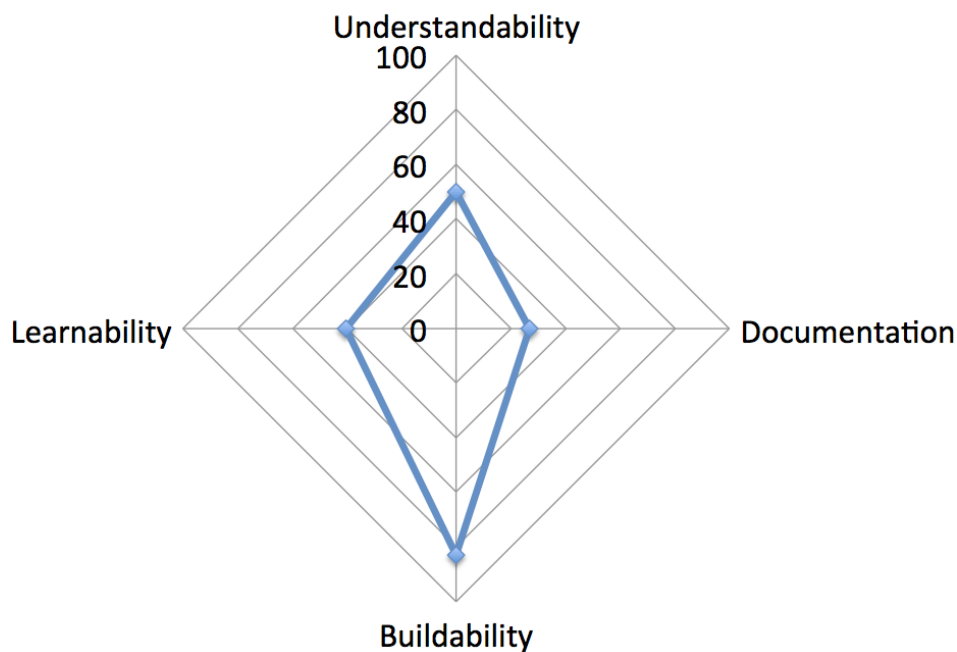


API documentation e.g. JavaDoc or Doxygen, documents APIs completely e.g. configuration files, property names etc.	0
Is held under version control alongside the code.	0
Is on the project web site.	0
Documentation on the project web site makes it clear what version of the software the documentation applies to.	0
<b>Summary</b>	<b>26,8</b>

	<b>Upload Tool</b>
<b>Buildability</b>	
Was the tool stable running	83
Was the tool fast responding	83
<b>Summary</b>	<b>83</b>

	<b>Upload Tool</b>
<b>Learnability</b>	
How straightforward is it to learn how to achieve:	
• Basic functional tasks?	83
• Advanced functional tasks?	100
A getting started guide is provided outlining a basic example of using the software.	33
Instructions are provided for many basic use cases.	33
Instructions are provided supporting all use cases.	17
Reference guides are provided for all command-line, GUI and configuration options.	17
API documentation is provided for user-developers and developers.	0
<b>Summary</b>	<b>40,4</b>

In summary the usability of the Upload Tool is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



In addition the following comments were given:

**Understandability:**

Easy to use

It is not clear how can we upload new files

**Documentation:**

No comments are given.

**Buildability:**

No comments are given.

**Learnability:**

No comments are given.

**General comments regarding usability:**

Not so easy

Very easy to use

usability is good in general

## 8.6.2 Results of sustainability and Maintenance

Details of the results to each item are given in the following tables. All numbers are percentages calculated as described above.

	Upload Tool
<b>Identity</b>	
To what extent is the identity of the project/software clear and unique both within its application domain and generally?	33
Project/software has its own domain name.	50
Project/software has a logo.	33
Project/software has a distinct name within its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	17
Project/software has a distinct name regardless of its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	17
Project/software name does not throw up embarrassing “did you mean...” hits on Google.	17
Project/software name does not violate an existing trade-mark.	0
<b>Summary</b>	<b>23,9</b>

	Upload Tool
<b>Copyright</b>	
To what extent is it clear who wrote the software and owns its copyright?	67
Web site states copyright.	17
Web site states who developed/develops the software, funders etc.	17
If there are multiple web sites then these all state exactly the same copyright, licencing and authorship.	17
Each source code file has a copyright statement.	0
If supported by the language, each source code file has a copyright statement embedded within a constant.	0
Each source code file has a licence header.	0
<b>Summary</b>	<b>16,9</b>

	Upload Tool
<b>Licencing</b>	
Has an appropriate licence been adopted?	0
Web site states licence.	0
Software (source and binaries) has a licence.	0
Software has an open source licence.	0
Software has an Open Software Initiative <sup>9</sup> (OSI)-recognised licence.	0
<b>Summary</b>	<b>0,0</b>

	Upload Tool
<b>Governance</b>	
To what extent does the project make its management, or how its software development is managed, transparent?	67
Project has defined a governance policy.	17
Governance policy is publicly available.	17
<b>Summary</b>	<b>33,7</b>

	Upload Tool
<b>Community</b>	
To what extent does/will an active user community exist for this product?	34
Web site has statement of number of users/developers/members.	17
Web site has success stories.	0
Web site has quotes from satisfied users.	17
Web site has list of important partners or collaborators.	17
Web site has list of the project's publications.	17
Web site has list of third-party publications that cite the software.	0
Web site has list of software that uses/bundles this software.	0

<sup>9</sup> <http://www.opensource.org/>

Users are requested to cite the project if publishing papers based on results derived from the software.	17
Users are required to cite a boilerplate citation if publishing papers based on results derived from the software.	0
Users exist who are not members of the project.	17
Developers exist who are not members of the project.	0
<b>Summary</b>	<b>11,3</b>

	<b>Upload Tool</b>
<b>Accessibility</b>	
To what extent is the software accessible?	67
Binary distributions are available (whether for free, payment, registration).	50
Binary distributions are freely available.	17
Binary distributions are available without the need for any registration or authorisation of access by the project.	0
Source distributions are available (whether for free, payment, registration).	0
Source distributions are freely available.	0
Source distributions are available without the need for any registration or authorisation of access by the project.	0
Access to source code repository is available (whether for free, payment, registration).	0
Anonymous read-only access to source code repository.	0
Ability to browse source code repository online.	0
Repository is hosted externally to a single organisation/ institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of any current funding line.	0
Downloads page shows evidence of regular releases (e.g. six monthly, bi-weekly, etc.).	0
<b>Summary</b>	<b>11,2</b>

	<b>Upload Tool</b>
<b>Testability</b>	
How straightforward is it to test the software to verify modifications?	83
Project has unit tests.	33
Project has integration tests.	33
For GUIs, project uses automated GUI test frameworks.	0

Project has scripts for testing scenarios that have not been automated (e.g. for testing GUIs).	17
Project recommends tools to check conformance to coding standards.	0
Project has automated tests to check conformance to coding standards.	0
Project recommends tools to check test coverage.	17
Project has automated tests to check test coverage.	17
A minimum test coverage level that must be met has been defined.	0
There is an automated test for this minimum test coverage level.	0
Tests are automatically run nightly.	0
Continuous integration is supported – tests are automatically run whenever the source code changes.	0
Test results are visible to all developers/members.	17
Test results are visible publicly.	0
Test results are e-mailed to a mailing list.	33
This e-mailing list can be subscribed to by anyone.	0
Project specifies how to set up external resources e.g. FTP servers, databases for tests.	0
Tests create their own files, database tables etc.	0
<b>Summary</b>	<b>13,2</b>

	<b>Upload Tool</b>
<b>Portability</b>	
To what extent can the software be used on other platforms?	100
Application can be built on and run under Windows.	83
Application can be built on and run under Windows 7.	83
Application can be built on and run under Windows XP.	50
Application can be built on and run under Windows Vista.	33
Application can be built on and run under UNIX/Linux.	33
Application can be built on and run under Solaris.	33
Application can be built on and run under RedHat.	17
Application can be built on and run under Debian.	17
Application can be built on and run under Fedora.	17
Application can be built on and run under Ubuntu.	17
Application can be built on and run under MacOSX.	17

Browser applications run under Internet Explorer.	17
Browser applications run under Mozilla Firefox.	33
Browser applications run under Google Chrome.	33
Browser applications run under Opera.	0
Browser applications run under Safari.	17
<b>Summary</b>	<b>35,3</b>

	<b>Upload Tool</b>
<b>Supportability</b>	
To what extent will the product be supported currently and in the future?	83
Web site has page describing how to get support.	17
User doc has page describing how to get support.	17
Software describes how to get support (in a README for command-line tools or a Help=>About window in a GUI).	17
Above pages/windows/files describe, or link to, a description of “how to ask for help” e.g. cite version number, send transcript, error logs etc.	17
Project has an e-mail address.	33
Project e-mail address has project domain name.	33
E-mails are read by more than one person.	33
E-mails are archived.	17
E-mail archives are publicly readable.	0
E-mail archives are searchable.	0
Project has a ticketing system.	17
Ticketing system is publicly readable.	0
Ticketing system is searchable.	0
Web site has site map or index.	33
Web site has search facility.	17
Project resources are hosted externally to a single organisation/institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of the current project.	17
E-mail archives or ticketing system shows that queries are responded to within a week (not necessarily fixed, but at least looked at and a decision taken as to their priority).	17
If there is a blog, is it is regularly used.	17
E-mail lists or forums, if present, have regular posts.	17
<b>Summary</b>	<b>20,1</b>

	Upload Tool
<b>Analysability</b>	
How straightforward is it to analyse the software's source release to:	
• To understand its implementation architecture?	34
• To understand individual source code files and how they fit into the implementation architecture?	50
Source code is structured into modules or packages.	17
Source code structure relates clearly to the architecture or design.	17
Project files for IDEs are provided.	0
Source code repository is a revision control system.	0
Structure of the source code repository and how this maps to the software's components is documented.	0
Source releases are snapshots of the repository.	0
Source code is commented.	0
Source code comments are written in an API document generation mark-up language e.g. JavaDoc or Doxygen.	0
Source code is laid out and indented well.	0
Source code uses sensible class, package and variable names.	0
There are no old source code files that should be handled by version control e.g. "SomeComponentOld.java".	0
There is no commented out code.	0
There are no TODOs in the code.	0
Auto-generated source code is in separate directories from other source code.	0
How to regenerate the auto-generated source code is documented.	0
Coding standards are recommended by the project.	0
Coding standards are required to be observed.	0
Project-specific coding standards are consistent with community or generic coding standards (e.g. for C, Java, FORTRAN etc.).	17
<b>Summary</b>	<b>6,75</b>

	Upload Tool
<b>Changeability</b>	



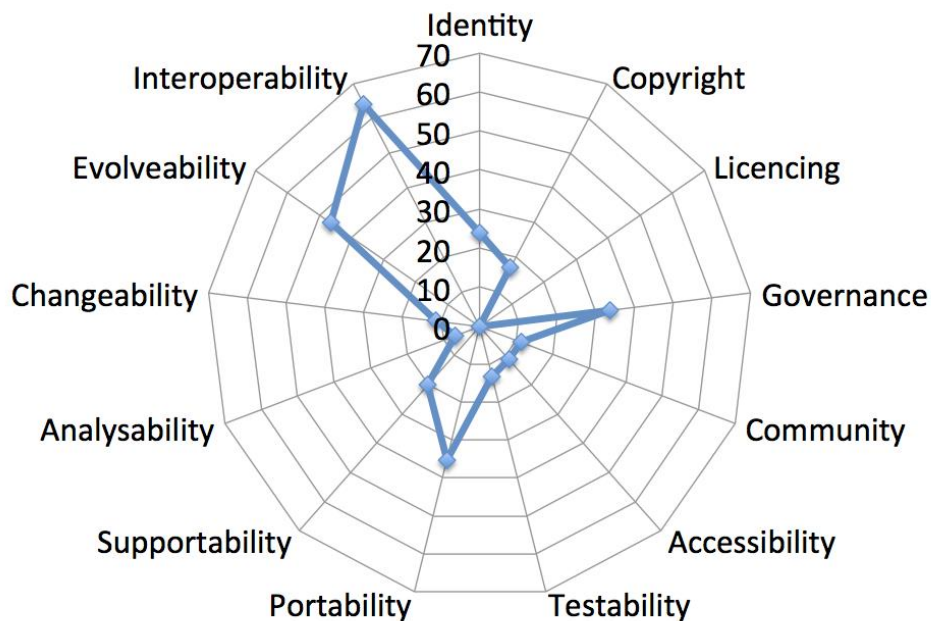
How straightforward is it to modify the software to:	
• Address issues?	50
• Modify functionality?	50
• Add new functionality?	50
Project has defined a contributions policy.	0
Contributions policy is publicly available.	0
Contributors retain copyright/IP of their contributions.	0
Users, user-developers and developers who are not project members can contribute.	0
Project has defined a stability/deprecation policy for components, APIs etc.	0
Stability/deprecation policy is publicly available.	0
Releases document deprecated components/APIs in that release.	0
Releases document removed/changed components/APIs in that release.	0
Changes in the source code repository are e-mailed to a mailing list.	0
This e-mailing list can be subscribed to by anyone.	0
<b>Summary</b>	<b>11,5</b>

	<b>Upload Tool</b>
<b>Evolveability</b>	
To what extent will the product be developed in the future:	
• For a future release?	67
• Within a roadmap for the product?	50
Web site describes project roadmap or plans or milestones (either on a web page or within a ticketing system).	33
Web site describes how project is funded/sustained.	50
Web site describes end dates of current funding lines.	33
<b>Summary</b>	<b>46,6</b>

	<b>Upload Tool</b>
<b>Interoperability</b>	

To what extent does the software's interoperability:	
• Meet appropriate open standards?	67
• Function with required third-party components?	67
• Function with optional third-party components?	67
Uses open standards.	67
Uses mature, ratified, non-draft open standards.	50
Provides tests demonstrating compliance to open standards.	67
<b>Summary</b>	<b>64,2</b>

In summary the sustainability & maintenance of the Upload Tool is given in the following Radar plot, where numbers are percentages and 100 is the optimal value.



Most of the values are below 50% and even 40% showing that there is a lack of sustainability and maintenance. One of the reasons for these results is also the fact that information about many of the items was missing by the evaluators, so that documentation about maintenance and sustainability needs to be improved.

In addition to the numbers the following comments were given:

**General comments regarding sustainability & maintenance:**

Sustainability is good in general.

**A detailed overview of usability and sustainability & maintenance is online available:**

[https://docs.google.com/forms/d/10kli5exkvQ0\\_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewanalytics](https://docs.google.com/forms/d/10kli5exkvQ0_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewanalytics)

## 9 Summary and conclusion

### 9.1 Comparison of the different tools

#### 9.1.1 Usability

In the following tables the different categories of usability are shown in detail comparing the five evaluated tools.

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Understandability</b>					
How straightforward is it to understand:	76	90	100	100	83
• What the software does and its purpose?					
• The intended market and users of the software?	63	70	84	92	83
• The software's basic functions?	88	80	83	100	83
• The software's advanced functions?	75	60	42	67	67
High-level description of what/who the software is for is available.	63	80	67	33	33
High-level description of what the software does is available.	63	60	75	25	33
High-level description of how the software works is available.	50	50	67	33	33
Design rationale is available – why it does it the way it does.	38	40	42	33	33
Architectural overview, with diagrams, is available.	25	30	25	25	17
Descriptions of intended use cases are available.	25	60	42	33	33
Case studies of use are available.	13	60	42	25	50
<b>Summary</b>	<b>52,6</b>	<b>61,8</b>	<b>60,8</b>	<b>51,4</b>	<b>49,8</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Documentation</b>					
Looking at the user documentation, what is its	87	90	100	75	84
• Quality?					
• Completeness?	100	90	100	75	84
• Accuracy?	100	90	100	83	84
• Appropriateness?	100	90	100	83	84
• Clarity?	100	90	100	75	67
Provides a high-level overview of the software.	63	70	75	33	17
Partitioned into sections for users, user-developers and developers (depending on the software).	25	10	33	8	33
States assumed background and expertise of the reader, for each class of user.	38	30	25	17	17
Lists resources for further information.	13	60	33	8	17
Further information is suitable for the level of the reader, for each class of user.	25	30	25	17	0
Is task-oriented.	38	80	50	42	50
Consists of clear, step-by-step instructions.	63	80	83	50	17
Gives examples of what the user can see at each step e.g. screen shots or command-line excerpts.	50	70	75	58	17
For problems and error messages, the symptoms and step-by-step solutions are provided.	25	20	17	0	0
Does not use terms like “intuitive”, “user friendly”, “easy to use”, “simple” or “obviously”, unless as part of quotes from satisfied users	38	60	42	33	33
States command names and syntax, says what menus to use, lists parameters and error messages exactly as they appear or should be typed.	13	50	58	17	33
Uses teletype-style fonts for command-line inputs and outputs, source code fragments, function names, class names etc.	13	20	25	0	0
For Java, the package names of classes are stated the first time	0	0	8	0	0

a class is mentioned.					
English language descriptions of commands or errors are provided but only to complement the above.	13	50	33	8	33
Plain-text files (e.g. READMEs) use indentation and underlining (e.g. === and ---) to structure the text.	0	20	25	0	0
Plain-text files (e.g. READMEs) do not use TAB characters to indent the text.	0	10	33	0	0
API documentation e.g. JavaDoc or Doxygen, documents APIs completely e.g. configuration files, property names etc.	0	0	17	0	0
Is held under version control alongside the code.	0	0	25	8	0
Is on the project web site.	0	40	67	17	0
Documentation on the project web site makes it clear what version of the software the documentation applies to.	0	30	58	8	0
<b>Summary</b>	<b>36,16</b>	<b>47,2</b>	<b>52,28</b>	<b>28,6</b>	<b>26,8</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Buildability</b>					
Was the tool stable running	100	100	83	100	83
Was the tool fast responding	88	60	92	100	83
<b>Summary</b>	<b>94</b>	<b>80</b>	<b>87,5</b>	<b>100</b>	<b>83</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Learnability</b>					
How straightforward is it to learn how to achieve:					
• Basic functional tasks?	88	80	100	92	83
• Advanced functional tasks?	75	60	75	84	100
A getting started guide is provided outlining a basic example of using the software.	75	60	67	50	33

Instructions are provided for many basic use cases.	38	40	58	50	33
Instructions are provided supporting all use cases.	38	50	42	25	17
Reference guides are provided for all command-line, GUI and configuration options.	25	30	33	17	17
API documentation is provided for user-developers and developers.	13	10	42	25	0
<b>Summary</b>	<b>50,3</b>	<b>47,13</b>	<b>59,6</b>	<b>49,0</b>	<b>40,4</b>

The four tables above can be summarized in the following figure, where the colours represent the values given in the above tables (Green: between 80 and 100%; yellow: between 60 and 80%; orange: between 40 and 60% and red below 40%).

	<b>DrEye</b>	<b>BraTumIA</b>	<b>CCGVIS</b>	<b>Timeline &amp; Data repository</b>	<b>Upload tool</b>
<b>Understandability</b>	Yellow	Yellow	Orange	Orange	Orange
<b>Documentation</b>	Orange	Orange	Red	Red	Red
<b>Buildability</b>	Green	Yellow	Green	Green	Green
<b>Learnability</b>	Orange	Orange	Orange	Orange	Orange

This table shows that none of the five evaluated tools is perfect regarding usability. DrEye and BraTumIA are the best compared to the others. Four of the five tools are stable running and fast responding (Buildability). In all tools Documentation needs to be improved. This is one of the reasons why sustainability & maintenance is difficult to judge as found in all evaluation reports of the different tools. These results are forwarded to the developers so that they can start improving the tools.





## 9.1.2 Sustainability and Maintenance

In the following tables the different categories of sustainability and maintenance are shown in detail comparing the five evaluated tools.

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Identity</b>					
To what extent is the identity of the project/software clear and unique both within its application domain and generally?	25	30	42	25	33
Project/software has its own domain name.	25	50	67	50	50
Project/software has a logo.	25	50	58	17	33
Project/software has a distinct name within its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	25	50	50	8	17
Project/software has a distinct name regardless of its application area. A search by Google on the name plus keywords from the application area throws up the project web site in the first page of matches.	25	40	25	17	17
Project/software name does not throw up embarrassing “did you mean...” hits on Google.	0	0	0	0	17
Project/software name does not violate an existing trade-mark.	0	0	0	8	0
<b>Summary</b>	<b>17,9</b>	<b>31,4</b>	<b>34,6</b>	<b>17,9</b>	<b>23,9</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Copyright</b>					
To what extent is it clear who wrote the software and owns its copyright?	63	50	92	8	67
Web site states copyright.	0	20	58	17	17

Web site states who developed/develops the software, funders etc.	13	60	83	50	17
If there are multiple web sites then these all state exactly the same copyright, licencing and authorship.	0	20	8	0	17
Each source code file has a copyright statement.	0	10	8	0	0
If supported by the language, each source code file has a copyright statement embedded within a constant.	0	0	0	0	0
Each source code file has a licence header.	0	0	0	0	0
<b>Summary</b>	<b>10,9</b>	<b>22,9</b>	<b>35,6</b>	<b>10,7</b>	<b>16,9</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Licensing</b>					
Has an appropriate licence been adopted?	0	20	50	0	0
Web site states licence.	0	30	58	8	0
Software (source and binaries) has a licence.	0	10	17	25	0
Software has an open source licence.	0	30	8	17	0
Software has an Open Software Initiative <sup>10</sup> (OSI)-recognised licence.	0	0	8	8	0
<b>Summary</b>	<b>0,0</b>	<b>18</b>	<b>28,2</b>	<b>11,6</b>	<b>0,0</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Governance</b>					
To what extent does the project make its management, or how its software development is managed, transparent?	25	40	50	42	67
Project has defined a governance policy.	0	0	33	17	17
Governance policy is publicly available.	0	0	17	17	17
<b>Summary</b>	<b>8,3</b>	<b>13,3</b>	<b>33,3</b>	<b>25,3</b>	<b>33,7</b>

<sup>10</sup> <http://www.opensource.org/>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Community</b>					
To what extent does/will an active user community exist for this product?	51	60	50	58	34
Web site has statement of number of users/developers/members.	25	20	25	17	17
Web site has success stories.	13	10	0	0	0
Web site has quotes from satisfied users.	25	10	0	17	17
Web site has list of important partners or collaborators.	25	40	42	42	17
Web site has list of the project's publications.	25	50	17	25	17
Web site has list of third-party publications that cite the software.	25	10	8	0	0
Web site has list of software that uses/bundles this software.	13	0	17	17	0
Users are requested to cite the project if publishing papers based on results derived from the software.	25	50	8	17	17
Users are required to cite a boilerplate citation if publishing papers based on results derived from the software.	25	50	17	0	0
Users exist who are not members of the project.	13	30	33	17	17
Developers exist who are not members of the project.	13	10	17	0	0
<b>Summary</b>	<b>23,2</b>	<b>28,3</b>	<b>19,5</b>	<b>17,5</b>	<b>11,3</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Accessibility</b>					
To what extent is the software accessible?	63	80	75	84	67
Binary distributions are available (whether for free, payment, registration).	13	30	92	17	50
Binary distributions are freely available.	0	30	100	0	17
Binary distributions are available without the need for	0	0	83	0	0

any registration or authorisation of access by the project.					
Source distributions are available (whether for free, payment, registration).	0	10	42	0	0
Source distributions are freely available.	0	10	33	0	0
Source distributions are available without the need for any registration or authorisation of access by the project.	0	0	33	0	0
Access to source code repository is available (whether for free, payment, registration).	0	0	17	0	0
Anonymous read-only access to source code repository.	0	0	17	0	0
Ability to browse source code repository online.	0	0	17	0	0
Repository is hosted externally to a single organisation/ institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of any current funding line.	0	0	25	17	0
Downloads page shows evidence of regular releases (e.g. six monthly, bi-weekly, etc.).	0	10	8	0	0
<b>Summary</b>	<b>6,3</b>	<b>14,2</b>	<b>45,2</b>	<b>9,8</b>	<b>11,2</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Testability</b>					
How straightforward is it to test the software to verify modifications?	38	50	50	58	83
Project has unit tests.	13	30	17	42	33
Project has integration tests.	13	20	17	33	33
For GUIs, project uses automated GUI test frameworks.	13	0	8	0	0
Project has scripts for testing scenarios that have not been automated (e.g. for testing GUIs).	13	0	8	0	17
Project recommends tools to check conformance to coding standards.	13	0	8	0	0
Project has automated tests to check conformance to coding	13	0	8	0	0

standards.					
Project recommends tools to check test coverage.	13	0	8	8	17
Project has automated tests to check test coverage.	0	0	8	0	17
A minimum test coverage level that must be met has been defined.	0	0	8	0	0
There is an automated test for this minimum test coverage level.	0	0	8	8	0
Tests are automatically run nightly.	0	0	8	0	0
Continuous integration is supported – tests are automatically run whenever the source code changes.	0	0	17	0	0
Test results are visible to all developers/members.	0	0	8	17	17
Test results are visible publicly.	0	0	8	0	0
Test results are e-mailed to a mailing list.	13	0	8	8	33
This e-mailing list can be subscribed to by anyone.	0	1	8	0	0
Project specifies how to set up external resources e.g. FTP servers, databases for tests.	0	0	8	0	0
Tests create their own files, database tables etc.	0	0	8	0	0
<b>Summary</b>	<b>7,5</b>	<b>5,3</b>	<b>11,6</b>	<b>9,2</b>	<b>13,2</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Portability</b>					
To what extent can the software be used on other platforms?	25	40	42	50	100
Application can be built on and run under Windows.	100	90	92	75	83
Application can be built on and run under Windows 7.	88	90	100	58	83
Application can be built on and run under Windows XP.	50	20	67	33	50
Application can be built on and run under Windows Vista.	25	10	50	25	33
Application can be built on and run under UNIX/Linux.	13	10	8	17	33
Application can be built on and run under Solaris.	0	0	8	8	33
Application can be built on and run under RedHat.	0	0	17	8	17
Application can be built on and run under Debian.	0	0	8	8	17

Application can be built on and run under Fedora.	0	0	8	8	17
Application can be built on and run under Ubuntu.	13	10	8	17	17
Application can be built on and run under MacOSX.	13	10	8	17	17
Browser applications run under Internet Explorer.	13	10	17	33	17
Browser applications run under Mozilla Firefox.	13	10	25	50	33
Browser applications run under Google Chrome.	13	10	25	50	33
Browser applications run under Opera.	0	0	17	17	0
Browser applications run under Safari.	0	0	17	17	17
<b>Summary</b>	<b>21,5</b>	<b>18,2</b>	<b>30,4</b>	<b>50,0</b>	<b>35,3</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Supportability</b>					
To what extent will the product be supported currently and in the future?	50	40	92	50	83
Web site has page describing how to get support.	13	30	42	58	17
User doc has page describing how to get support.	25	20	25	25	17
Software describes how to get support (in a README for command-line tools or a Help=>About window in a GUI).	25	30	33	17	17
Above pages/windows/files describe, or link to, a description of "how to ask for help" e.g. cite version number, send transcript, error logs etc.	25	20	17	25	17
Project has an e-mail address.	25	70	58	58	33
Project e-mail address has project domain name.	13	10	50	33	33
E-mails are read by more than one person.	0	0	17	25	33
E-mails are archived.	0	0	25	17	17
E-mail archives are publicly readable.	0	0	25	0	0
E-mail archives are searchable.	0	0	25	0	0
Project has a ticketing system.	0	0	17	25	17
Ticketing system is publicly readable.	0	0	8	25	0
Ticketing system is searchable.	0	0	8	25	0

Web site has site map or index.	0	30	42	8	33
Web site has search facility.	0	20	33	33	17
Project resources are hosted externally to a single organisation/institution in a sustainable third-party repository (e.g. SourceForge, GoogleCode, LaunchPad, GitHub), which will live beyond the lifetime of the current project.	0	20	17	8	17
E-mail archives or ticketing system shows that queries are responded to within a week (not necessarily fixed, but at least looked at and a decision taken as to their priority).	0	0	8	0	17
If there is a blog, is it regularly used.	0	0	8	0	17
E-mail lists or forums, if present, have regular posts.	0	0	8	8	17
<b>Summary</b>	<b>8,8</b>	<b>14,5</b>	<b>27,9</b>	<b>22</b>	<b>20,1</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Analysability</b>					
How straightforward is it to analyse the software's source release to:					
<ul style="list-style-type: none"> <li>To understand its implementation architecture?</li> </ul>	25	20	25	33	34
<ul style="list-style-type: none"> <li>To understand individual source code files and how they fit into the implementation architecture?</li> </ul>	25	10	25	25	50
Source code is structured into modules or packages.	25	20	33	8	17
Source code structure relates clearly to the architecture or design.	25	20	17	8	17
Project files for IDEs are provided.	13	0	8	0	0
Source code repository is a revision control system.	0	10	8	17	0
Structure of the source code repository and how this maps to the software's components is documented.	13	10	17	8	0
Source releases are snapshots of the repository.	13	10	17	8	0

Source code is commented.	25	20	8	8	0
Source code comments are written in an API document generation mark-up language e.g. JavaDoc or Doxygen.	0	10	8	8	0
Source code is laid out and indented well.	25	20	17	25	0
Source code uses sensible class, package and variable names.	13	20	17	17	0
There are no old source code files that should be handled by version control e.g. "SomeComponentOld.java".	0	10	8	8	0
There is no commented out code.	0	0	8	0	0
There are no TODOs in the code.	0	0	8	0	0
Auto-generated source code is in separate directories from other source code.	0	0	8	8	0
How to regenerate the auto-generated source code is documented.	0	0	8	8	0
Coding standards are recommended by the project.	0	10	8	0	0
Coding standards are required to be observed.	0	0	8	0	0
Project-specific coding standards are consistent with community or generic coding standards (e.g. for C, Java, FORTRAN etc.).	0	10	8	0	17
<b>Summary</b>	<b>10,1</b>	<b>10</b>	<b>13,2</b>	<b>9,45</b>	<b>6,75</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Changeability</b>					
How straightforward is it to modify the software to:					
• Address issues?	50	30	25	25	50
• Modify functionality?	38	40	34	25	50
• Add new functionality?	38	30	50	25	50
Project has defined a contributions policy.	13	30	33	0	0
Contributions policy is publicly available.	0	20	42	0	0
Contributors retain copyright/IP of their contributions.	0	10	17	0	0
Users, user-developers and developers who are not project	13	10	50	0	0



members can contribute.					
Project has defined a stability/deprecation policy for components, APIs etc.	0	10	17	8	0
Stability/deprecation policy is publicly available.	0	10	17	8	0
Releases document deprecated components/APIs in that release.	0	10	8	8	0
Releases document removed/changed components/APIs in that release.	0	10	8	8	0
Changes in the source code repository are e-mailed to a mailing list.	0	10	8	0	0
This e-mailing list can be subscribed to by anyone.	0	10	8	0	0
<b>Summary</b>	<b>11,7</b>	<b>17,7</b>	<b>24,4</b>	<b>8,2</b>	<b>11,5</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Evolveability</b>					
To what extent will the product be developed in the future:					
• For a future release?	63	40	59	50	67
• Within a roadmap for the product?	50	40	41	33	50
Web site describes project roadmap or plans or milestones (either on a web page or within a ticketing system).	13	0	17	17	33
Web site describes how project is funded/sustained.	50	30	67	50	50
Web site describes end dates of current funding lines.	13	0	25	8	33
<b>Summary</b>	<b>37,8</b>	<b>22</b>	<b>41,8</b>	<b>31,6</b>	<b>46,6</b>

	CCGVIS	BraTumIA	DrEye	Timeline % Data Repository	Upload Tool
<b>Interoperability</b>					
To what extent does the software's interoperability:					
• Meet appropriate open standards?	38	30	50	33	67

• Function with required third-party components?	38	30	59	33	67
• Function with optional third-party components?	50	40	50	25	67
Uses open standards.	25	30	59	33	67
Uses mature, ratified, non-draft open standards.	25	30	59	17	50
Provides tests demonstrating compliance to open standards.	25	30	42	25	67
<b>Summary</b>	<b>33,5</b>	<b>31,7</b>	<b>53,2</b>	<b>27,7</b>	<b>64,2</b>

The above tables above can be summarized in the following figure, where the colours represent the values given in the above tables (Green: between 80 and 100%; yellow: between 60 and 80%; orange: between 40 and 60% and red below 40%).

	DrEye	BraTumIA	CCGVIS	Timeline & Data repository	Upload tool
<b>Identity</b>					
<b>Copyright</b>					
<b>Licencing</b>					
<b>Governance</b>					
<b>Community</b>					
<b>Accessibility</b>					
<b>Testability</b>					
<b>Portability</b>					
<b>Supportability</b>					
<b>Analysability</b>					
<b>Changeability</b>					
<b>Evolveability</b>					
<b>Interoperability</b>					

As clearly seen in the above figure sustainability and maintenance is less than suboptimal. In all categories improvements are needed. These results are forwarded to the whole consortium and especially to the developers to improve sustainability and maintenance of all evaluated tools. For that purpose the virtual machines are still open to evaluate the tools after improvement. Results can always be found online. The corresponding links are given in the evaluation report and the references below for each of the tools.



## 10 References

- [1] <http://www.opensource.org/>
- [2] Detailed evaluation reports of the first evaluation round of CHIC:
  - Upload Tool:  
[https://docs.google.com/forms/d/10kli5exkvQ0\\_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewanalytics](https://docs.google.com/forms/d/10kli5exkvQ0_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewanalytics)
  - DrEye:  
[https://docs.google.com/forms/d/1wxYCM\\_nCpUFry-Doyg\\_4ltfy\\_GgoaYLpGJWo0LCo21c/viewanalytics](https://docs.google.com/forms/d/1wxYCM_nCpUFry-Doyg_4ltfy_GgoaYLpGJWo0LCo21c/viewanalytics)
  - BraTumIA:  
<https://docs.google.com/forms/d/14vtbaXbQR0HCEwGYF4IPtXCuUwf-5Ekxxf6O9RukKt0/viewanalytics>
  - CCGVis and volume rendering:  
[https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF\\_W0y0KikAvgphztv0/viewanalytics](https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF_W0y0KikAvgphztv0/viewanalytics)
  - Timeline and clinical data repository:  
[https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b\\_1xAwVB7\\_zF4Q01DPC470Jd2U/viewanalytics](https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b_1xAwVB7_zF4Q01DPC470Jd2U/viewanalytics)
- [3] Evaluation questionnaires:
  - DrEye
    - [https://docs.google.com/forms/d/1wxYCM\\_nCpUFry-Doyg\\_4ltfy\\_GgoaYLpGJWo0LCo21c/viewform](https://docs.google.com/forms/d/1wxYCM_nCpUFry-Doyg_4ltfy_GgoaYLpGJWo0LCo21c/viewform)
  - BraTumIA and brain segmentation
    - <https://docs.google.com/forms/d/14vtbaXbQR0HCEwGYF4IPtXCuUwf-5Ekxxf6O9RukKt0/viewform>
  - CCGVis and volume rendering
    - [https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF\\_W0y0KikAvgphztv0/viewform](https://docs.google.com/forms/d/1IPTxtQf4uVInbZhwm9OGgfluKF_W0y0KikAvgphztv0/viewform)
  - Timeline and clinical data repository
    - [https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b\\_1xAwVB7\\_zF4Q01DPC470Jd2U/viewform](https://docs.google.com/forms/d/19QhWfwhhvSXX7-1e2b_1xAwVB7_zF4Q01DPC470Jd2U/viewform)
  - Upload tool
    - [https://docs.google.com/forms/d/10kli5exkvQ0\\_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewform](https://docs.google.com/forms/d/10kli5exkvQ0_ajYq7ckf3Ch-xfW1pZroLNoRHYN-FZ4/viewform)